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A
NEW SYSTEM
OF
Practical Husbandry;

By JOHN MILLS, Eſq; F.R.S.

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of Roüen, and of the Œconomical Society of Berne.

> Omnium rerum ex quibus aliquid conquiritur, nihil eſt AGRICULTURA melius, nihil uberius, nihil dulcius, nihil homide, nihil libero dignius.
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PREFACE.

THE general principles of Agriculture, and the method of raiſing each different kind of Grain and Pulſe in the broad-caſt or old Huſbandry, having been treated of in the former volume of this work; I proceed here to give the beſt account which actual Experiments enable me to do, of the Horſe-hoeing or new Huſbandry: a ſubject of the utmoſt importance to farmers, as it has pointed out an infallible way to improve almoſt every ſoil, independent of manures, or of any other help than that of the Plough. When I expreſs myſelf thus, I am far from meaning that manures are uſeleſs, or that the plough alone, or it's effect, pulveriſation, is the only thing requiſite for the improvement of land. On the contrary, I have already ſhewn the manifeſt advantages which accrue from various ſubſtances uſed as manures; and have made it appear pretty plainly, that, even in the new Huſbandry, the very roots and ſtubble of the plants cultivated in that way contribute greatly to enrich the earth.

To ſet this matter in the cleareſt light, I give, in the firſt Article of this Volume, directions for preparing the ground for the Horſe-hoeing Huſbandry, in which my chief guides are M. Duhamel and his correſpondents, whoſe experiments have enabled them to improve greatly on the plan firſt laid down by Mr. Tull; as will evidently appear to every impartial Reader, who ſhall peruſe the following ſheets with ſuch attention as the ſubject well deſerves.

Though I had before deſcribed, particularly, every Inſtrument neceſſary in Tillage, and did not then intend to reſume that topic; yet, upon re-conſidering M. de Chateauvieux's Drill-plough, which has afforded perfect ſatisfaction to all who have uſed it; and finding that it is, in fact, far from being ſo complex as the length of the deſcription, and the number of plates explanatory thereof, have induced many to ſuppoſe; I thought I could not omit it here, without injuſtice to ſuch of my countrymen as may not be able to conſult the original: a conſideration which, alone, would have been ſufficient to determine me; and which became irreſiſtable, when enforced by the deſire of ſeveral gentlemen of diſtinguiſhed rank and eminent abilities. No writer upon the eſſentially intereſting ſubject of Agriculture has juſter, clearer, or more extenſive ideas of whatever he treats, than M. de Chateauvieux.

This renders him minutely exact in all his deſcriptions; and that exactneſs here is ſo much elucidated by the accuracy of his drawings, that his explanation of the conſtruction and mechaniſm of his Drill cannot but be highly uſeful; were it only to ſuggeſt hints to ingenious artiſts, who may from thence endeavour to ſtrike out new improvements, as M. de la Levrie has done*.

M. de Chateauvieux, whoſe genius is ſingularly fertile in whatever concerns the advancement of Agriculture, has likewiſe invented Horſe hoes, or what he calls Cultivators, of an entirely new conſtruction. I have given his deſcriptions of them, together with that of another Cultivator invented by M. de Villiers. Theſe inſtruments, with their authors directions for uſing them, are the ſubject of my ſecond Article.

In the third Article of this volume, I relate a ſeries of Experiments on the culture of Grain and Pulſe in the Horſe-hoeing Huſbandry; in which M. de Chateauvieux continues to be my principal guide †. The judgment, accuracy, and candour which reign throughout all his accounts, would be injured by any attempt to abridge his narrative. I have therefore given the whole of what he has publiſhed on this ſubject.

The more exactly to aſcertain the value of his experiments, this illuſtrious Huſbandman not only makes, all along, juſt and concluſive compariſons of the crops in the new Huſbandry with thoſe in the old way; but alſo draws a ſenſible parallel between the former, and an improved manner of carrying on the latter, by ſowing the land all over, with the drill-plough, in equally diſtant rows. M. d'Elbene, adopting M. de Chateauvieux's ideas, carried on, for three years, a ſeries of experiments, which I have added to the former‡, becauſe they ſerve mutually to confirm each other: and to his exact accounts of the expences attending each method of culture, I have ſubjoined * an eſtimate, which I believe a juſt one, drawn up in the ſame view, with reſpect to this country, by the Editors of the laſt Edition of Mr. Tull's Horſe-hoeing Huſbandry †.

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* See p. 94. † See p. 122.

M. Rouſſel, who merits a diſtinguiſhed place among M. Duhamel's judicious correſpondents, has added manures to a thorough tillage; and has given, in his experiments, directions which may be of great ſervice to farmers §.

This Article concludes with experiments made on different kinds of Grain and Pulſe, which, being of leſs value than wheat, have not yet had an equal ſhare of attention beſtowed upon them; nor am I, for that reaſon, enabled to enlarge thereon.

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‡ See p. 319. * See p. 342. † The Third Edition, printed in 1751. § See p. 348.

Having thus gone through, and endeavoured to methodiſe, all that has occurred to me moſt worthy of notice in the various manners of cultivating the ſeveral ſpecies of Grain and Pulſe; I enter, in the ſecond chapter of this volume, upon a ſubject hitherto very imperfectly handled by our Engliſh authors, namely, The Diſtempers of Corn. In this, I have made uſe of every thing that M. Duhamel and the French writers in general have ſaid, and alſo of the practical directions of Count Ginanni, a Patrician of Ravenna, who has treated this important matter in the fulleſt and moſt complete manner ever yet attempted.

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PRACTICAL HUSBANDRY.

PART. II.

CHAP. I.

Of the Culture of GRAIN AND PULSE, *according to the Principles of the* HORSE-HOEING HUSBANDRY.

ENGLAND may juſtly boaſt of having given riſe to one of the greateſt improvements that any age has hitherto made in Agriculture. — Mr. Tull is undoubtedly intitled to the honour of having firſt thought of beſtowing upon Corn, that culture which had been found neceſſary for the Vine, and other perennial plants, or what is uſually called the

Horſe-hoeing Huſbandry; and in the proſecution of this, he gave proofs of the utility of thorough plowing, much beyond what was ever thought of before. — Though we find a ſtrong inſtance of the partiality of the human mind in favour of it's own productions, in his rating the advantages of plowing, or what he calls *pulveriſation*, ſo high as to render every other aſſiſtance needleſs; yet poſterity will ever be indebted to him, for having planned the truly ſenſible and beneficial practice; — the path in which foreigners, animated with a laudable ſpirit of emulation, are now treading, to the great emolument of individuals, and the conſpicuous advantage of their country.— I am ſorry to be obliged, after having done this juſtice to Mr. Tull, to paſs the ſevere cenſure on his and my conntrymen, that they have never yet given his method a fair trial; but have left a nation, our rival in glory, to determine it's intrinſic merit, at leaſt ſo far as candid and accurate experiments, that touch-ſtone of Arts, can throw a light upon the very intereſting ſubject, and aſcertain it's value.

The unthinking multitude may look upon this as a poor inſignificant victory over us: — but with the judicious Patriot, who rightly eſtimates the almoſt innumerable advantages which flow from improved Agriculture, the names of DUHAMEL, CHATEAUVIEUX, &c. will far out-weigh thoſe of the moſt vaunted heroes blazoned in the annals of war; and in another tract, the higheſt commendations will be deſervedly given to the Marquis of TURBILLY, who has doubled the number of inhabitants on his eſtate, and quadrupled it's produce, and this, not on a ſmall farm, or an inconſiderable ſpot, but upon a large extent of country: — an example, which, if followed, will become an infinitely more valuable, and a truly greater acquiſition to France, than ever warrior added to her territories. — Let us, at length, be warned and inſtructed! Let us imitate what is ſo well worthy of imitation!

As the benefits of thorough plowing have been pointed out in the former Volume of this work, and will be ſtill more particularly demonſtrated by the experiments which will follow; I ſhall now proceed, 1, to ſhew the manner of preparing the land for the Horſe-hoeing Huſbandry; 2, to deſcribe the inſtruments uſeful in, or, peculiar to, this Huſbandry, with the method of uſing them; and 3, to relate ſome of the experiments, by which we may judge of it's importance.

ARTICLE I.

Of preparing the Ground for the Horſe-hoeing Huſbandry.

EXPERIENCE ſhews, that land, though ever ſo well tilled in the autumn, when wheat for example, is ſown, hardens and ſaddens in the winter; it's particles, beaten down by heavy rains, and ſunk by their own weight, approach each other daily more and more; the roots of the plants cultivated have conſequently leſs and leſs room to extend themſelves in queſt of their neceſſary food; and the interſtices in the earth become of courſe ſo few and cloſe, that they are not able to pierce through them; whilſt weeds ſpring up, and rob them of their nouriſhment. By this means the earth, reduced to nearly the ſame condition as if it had not been plowed at all, is unable to aſſiſt the plants ſown in it, in the ſpring, when they ought to ſhoot with the greateſt vigour. They conſequently then ſtand moſt of all in need of the plough, to deſtroy the weeds, to lay freſh earth to their roots in the room of that which they have exhauſted, to break the particles of the ground anew, ſo as to enable their roots to ſpread, in order to their gathering an ample proviſion of food, which then does them the greateſt ſervice.

In the common Huſbandry, the whole attention is to provide a great ſtore of nouriſhment for the wheat at a time when it ſcarcely conſumes any, as it then produces only a few blades; after which it is left to itſelf, at a ſeaſon when it might, and ſhould, be moſt aſſiſted by proper culture: — a management as prepoſterous, as it would be to give a child a great deal of food, and diminiſh it gradually as he grows bigger; or, to uſe Mr. Tull's compariſon [a], to give to ſilk-worms, before they are hatched, treble the full ſtock of leaves neceſſary to maintain them till they have finiſhed their ſpinning, and not to allow them any when they really want being fed.

The great advantage of having land in fine tilth before it is ſowed, is univerſally acknowledged: but we muſt not ſtop at thoſe firſt preparations. Plants require a continuation of culture while they grow, and muſt not be forſaken till they have attained their full maturity.

Thoſe who are againſt the frequent plowings uſed in the New Huſbandry, are afraid of drying the earth too much; becauſe, ſay they, the moiſture eſcapes more eaſily from a well looſened ſoil, than from a hard and cloſe earth.

In anſwer to this, it will appear from many of the following experiments, that, even in the drieſt weather, land cultivated according to the new method continues conſtantly moiſter than that which is managed in the old way. Inſtead of a ſtagnant wet, more hurtful, perhaps, than beneficial, to plants [b]; earth made fine to a good depth, is prepared, as the Rev. Dr. Eliot expreſſes it [c], "with open mouth, to drink and retain the dew, "which, when it falls upon land that is untilled, "or but poorly tilled, does not ſink far, but is "carried off by the next day's ſun." —That dew is one of the greateſt fertilizers of the earth, has been repeatedly proved; and that it will penetrate ſo deep in a fine looſe ſoil, as to keep that moiſt, while the ground around it is parched up, appears, among many other demonſtrations, from Mr. Evelyn's experiment, before mentioned [d], of digging a hole, and filling it up with it's former mould well pulveriſed. — Or, as Mr. Tull obſerves [e], till a field in lands, make one land very fine by frequent deep plowings, and let another be rough, by inſufficient tillage, alternately: then plow the whole field croſs-ways in the drieſt weather, which has continued long; and you will perceive, by the colour of the earth, that every fine land will be turned up moiſt; but every rough land will be dry as powder, from top to bottom.

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[a] *Horſe-hoeing Huſbandry, p.* 48.

Another proof of the benefits which ariſe from ſtirring the ground well and often between plants, while they grow, and conſequently a confirmation of the fundamental principle of the Horſe-hoeing huſbandry, is thus drawn by Dr. Eliot [f], from the common manner of raiſing Indian corn.

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[b] DUHAMEL, *Eléments d'Agriculture, Tom.* I. *p.* 444.

[c] *Eſſays on Field-Huſbandry, p.* 108.

[d] *Vol.* I. *p.* 275.

[e] *Horſe-hoeing Huſbandry, p.* 51.

[f] *Ubi ſupra, p.* 113.

" The land, " ſays he ", being previouſly pre-
" pared, planted, and the corn come up, we plow
" a furrow off from the corn on each ſide, then
" hoe it, and the next time plow up to the corn;
" ſo that this tillage is nearly the ſame as is now
" propoſed for wheat, or whatever we would
" plant: only, by the way, I would obſerve, that
" the plowing between the rows (for Indian corn)
" is ſo ſhallow, that one would be apt to think it
" intended for nothing more than merely to kill
" the graſs and weeds; whereas it is found by
" experience, that, though there be neither graſs
" nor weeds, the plowing and hoeing will make
" the corn grow, and that the more the land is
" plowed and hoed, the better and longer it will
" reſiſt drought, and yield the better crop: nay,
" what is ſtill more remarkable, if the Indian
" corn be well tilled, the next crop, whether it
" be oats or flax, will be proportionably greater
" and better; ſo that the land muſt have gained
" ſtrength and richneſs. If it were not ſo, why
" did not the Indian crop exhauſt and ſpend the
" ſtrength of the land, eſpecially when we con-
" ſider how large that corn is made to grow by
" good tillage? But we find the contrary. — the
" better the crop of Indian, the better the crop
" will be of oats. There is no ſort of huſbandry,
" wherein the ſuperior force and virtue of tillage
" doth ſo evidently appear, as in the raiſing of
" Indian corn: for if you ſhould plow and
" harrow the beſt of land, and ſow or plant the
" corn, and never do any thing more to it, there
" will be leſs corn than if you ſhould plant poor
" land, and tend it well: the poor land well
" plowed and hoed, ſhall bring a greater crop
" than the rich land. We hereby ſee the efficacy
" and advantage of this repeated tillage, which
" falls in ſucceſſively, according to the exigency and
want

" want of the plant in it's ſeveral degrees of growth, " and keeps the land in a proper ſtate.—Why " ſhould it not have the ſame effect upon wheat, " and every other plant that is ſuſceptible of the " like culture."

If ſeveral rows of wheat are ſown in a poor but well-plowed land, the blades of the corn will turn yellow in the ſpring, eſpecially in dry weather. Let the earth bordering upon theſe rows be plowed deep, in ſome places near, and in others farther from the rows, and the plants will reſume their proper colour; firſt in the places neareſt to the new plowed ground, and afterwards gradually in the others, according to their diſtance: which proves that they recover their verdure, in proportion as their roots reach the looſe mould. This holds equally true in all plants: for Mr. Tull declares[g] that he does not remember ever to have ſeen a poor one, contiguous to a well-hoed interval, unleſs over-powered by a too great multitude of other plants, (an exception which muſt be equally made if it were a plant that required more or leſs heat or moiſture than the ſoil or climate afforded); and that, on the contrary, he has ſeen plants grow to an amazing ſize, when the earth around them has been frequently tilled. He mentions, among others, a plant of ray-graſs, which chanced to ſtand in a turnip field, where, being hoed as the turnips were, it acquired a bulk at leaſt equal to a thouſand plants of the ſame ſpecies; and a plant of muſtard, which grew higher than he could reach, ſo as to be more like a tree than an herb.

The ſtirring of the earth about plants whilſt they grow, is productive of ſuch excellent effects, that, in ſome parts of Berkſhire [h], and in many places in France [i], they hand-hoe their corn, particularly wheat, and find that the crops amply repay all the charge and trouble of this expenſive operation; which, however, cannot be performed but in well-peopled countries. Every huſbandman will immediately ſee, how much a hoe-plough is preferable for this work, and that, to uſe it rightly, the corn muſt neceſſarily be planted in regular rows, as it is in the new huſbandry.

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[g] p. 52.

Our reaſon tells us, that the longeſt lived plants ſtand moſt in need of this culture. Perennials require it more than annuals, and wheat which is ſown in autumn, and does not ripen till nine months after, wants it more than ſpring-corn, which occupies the ground only for a few months. The former has to conquer a ſoil rendered hard during the courſe of the winter; but the other has not that difficulty to ſurmount; though both of them, and indeed all ſorts of plants, are greatly invigorated by the repeated laying of fine freſh earth to their roots. Every one knows the vaſt efficacy of wood land, before its native ſtrength and vigour are exhauſted; and ſuch, in ſome degree, is that which this tillage furniſhes; beſides being conſtantly attended with the advantage of deſtroying weeds.—How far this laſt important part of agriculture was well executed by the *ſarcling*, or *ſarriſon*, as Mr. Tull calls it [k], of the ancients, I ſhall not pretend to ſay; becauſe we have no clear account of the manner in which it was performed: but it does not ſeem to have been in any way equal to the horſe-hoeing huſbandry, which likewiſe, among its many other excellencies, keeps the land from going out of tilth.

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[h] TULL. *p.* 57. [i] DUHAMEL, *Culture des Terres, Tom.* I. *p.* 123, & *Elements d'Agriculture. Tom.* I. *p.* 445. [k] *p.* 53.

The means of looſening land, by manure and by plowing, having been already treated of, and the effects of different manures accounted for, in the preceding volume of this work, I ſhall only add here the following obſervations on the uſe of *dung*, as given by M. Duhamel, in his *Elements of Agriculture*, of which that gentleman has been pleaſed to ſend me a copy *.

" It is often, ſays he [m], more advantageous to increaſe the fertility of land by *plowing*, than by *dung*: 1, Becauſe, in general, only a certain quantity of dung can be had, the product of twenty acres being ſcarcely ſufficient to produce enough for four or five; whereas the particles of the earth may be divided and ſubdivided almoſt to infinity. The help derived from dung is therefore limited; whilſt no bounds can be ſet to the benefits that may accrue from plowing."

" 2, Few plants raiſed in dung ever have the fine flavour of thoſe which grow in a good ſoil moderately dunged. Our kitchen gardens and our other grounds afford daily inſtances of this truth. Pulſe, pot-herbs, and fruit, are ſeldom ſo good in the neighbourhood of great cities, where dung abounds, as in country gardens, where but little of it is uſed. The corn raiſed in thoſe exceſſively dunged lands, yields a great deal of bran, and not much fine flour, and is difficult to keep. Nice horſes will not eat oats of the growth of fields manured with human ordure. But nothing is ſo ſtriking as the difference between the wine of an undunged vineyard, and that of vines which have been greatly dunged."

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* M. Duhamel was ſo very obliging as to ſend this copy as ſoon as his book was printed; but the difficulty of conveyance, occaſioned by the war, prevented my receiving it till very lately. However, it is ſtill come in time for me to do both to the author's generous intention, and to the public, the juſtice of enriching the future part of this work with many uſeful hints from that celebrated writer.

[m] *Tom.* I. *Liv.* II. *c.* 2. §. 1.

" 3, Dung, which is ſuppoſed to act by fermentation, cauſes indeed an inward diviſion of the particles of the earth, which muſt be very uſeful, as well as the food which it furniſhes to plants: but the plough, beſides dividing thoſe particles, changes their ſituation, and turns the ground upſide down, ſo that the part which was expoſed to the influences of the air and dews, takes the place of another part, which is brought from within the earth, up to its ſurface. The conſequence of this is, that well-plowed land is not exhauſted by weeds, and that it admits the moiſture of rains and dews, together with the rays of the ſun, all of which contribute greatly to render it fertile, as has been proved by very many experiments."

" 4, Dung attracts inſects, and thoſe inſects gnaw plants. It is well known that the roots of trees planted in dunged ground, are very liable to be damaged by inſects; and this is one of the chief reaſons why floriſts baniſh dung from their gardens. Worms, grubs, and other ſuch like vermin, make dreadful havock in their beds of flowers; and I have ſeen meadows where the graſs has been entirely deſtroyed, by their eating its roots."

" I muſt add, that moſt ſorts of dung contain a great many ſeeds, which fill the land with weeds."

" 5, It is true that dung is equally ſerviceable to light lands, and to ſtrong; but the ſame may be ſaid of plowing."

"Land is too ſtrong when its particles lie ſo cloſe together, that the roots of plants cannot extend between them, without great difficulty, in queſt of their neceſſary food, for want of which they will remain poor and ſickly. But when the ground has been well looſened by repeated plowings, and its particles are ſet at greater diſtances from each other, thoſe roots will be able to ſpread freely on all ſides, to pervade every minute chaſm, and to collect ſuch quantities of food, as will make the plants grow ſtrong and vigorous. The friendly influences of the atmoſphere will then penetrate to them. What plainly proves the good effects of looſening ſuch ſoils, is, that their fertility is ſometimes increaſed by a mixture of ſand, inſtead of dung. Now ſand does not afford any nutritive ſubſtance; but only hinders the particles of the earth from re-uniting too cloſely."

"Plowing is equally beneficial to light lands, for the very contrary reaſon; though theſe do not require ſo much of it as the other. There is no danger of their being exhauſted by any expoſure to the ſun; but, on the contrary, they acquire an additional degree of fertility by the ſtirring and grinding of their particles, and are thereby the better fitted to receive the moiſture of rains and dews, and the ſalutary influences of the air and ſun; whilſt their inward pores are at the ſame time better adapted to the proper extenſion of the roots of plants, by their being leſſened."

"But, let the benefits ariſing from dung be ever ſo great, let the means of obtaining enough of it be ever ſo eaſy, and let even its defects be corrected as much as can be; ſtill it will not be the leſs true, that frequent plowing is of infinite ſervice to land."

“ For this reaſon it is, that land intended for wheat is plowed three or four times before the grain is ſowed. Some farmers, who could not dung all their lands, plowed part of them double the uſual number of times, and reaped greater crops from theſe, than from thoſe which were dunged. The expence of three plowings extraordinary will be much leſs than the price of the dung neceſſary for the land, if the farmer is obliged to purchaſe it.

“ In 1759, M. Delu gave three plowings to ſome of his fields intended for oats; and though that year was very dry and unfavourable to ſpring-corn, his oats kept up well till they were perfectly ripe, and yielded a full crop of excellent grain.

“ He gave five plowings to a piece of wheat-land, which had not been dunged, and, at harveſt, had taller and finer corn there, than in the neighbouring grounds which had been dunged and cultivated in the uſual way.

“ In ſhort, the advantage of thorough tillage, while the plants are growing, is ſo great, that, in many places, it has been found amply to repay even the expence of digging between the rows of corn *.

“ The farmer muſt not think of practiſing the new huſbandry in land which cannot be brought to a fine tilth: for as no remedies are proper for all diſeaſes, ſo no one culture can ſuit every kind of ſoil.

“ I have met with very zealous huſbandmen, who have been in a great hurry to procure all the instru-

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* The reſt of this article is taken from the VIth Book of M. Duhamel's *Elements of Agriculture*, with ſome alterations in the order, for the ſake of greater brevity.

inſtruments proper for the horſe-hoeing huſbandry, before they had examined whether their ground was fit for uſing them. In walking over their fields, I have found them in ſo bad order, as to be full of clods, ſtones, and all ſorts of weeds: only the bare ſurface of the land had been ſcratched, by what they called plowing; and indeed their common inſtruments of tillage were ſo imperfect, that it was hardly poſſible for them to do more. I adviſed them, to deſtroy thoſe weeds by good and frequent plowing, to procure good inſtuments, to looſen the ground to a proper depth, to collect good manures, to drain their land well by trenches and ditches, and, in ſhort, to practiſe the old huſbandry completely, before they attempted the new; for, in fact, all the requiſites in the former muſt be the foundation of the latter.

" In order to practiſe the horſe-hoeing huſbandry, the farmer muſt be provided with proper inſtruments, of which a deſcription will be given in the next article.

" To anſwer the ends of this husbandry, the ſeed muſt be diſtributed ſo ſparingly, that each plant may have room to extend its roots in ſuch manner that they may be able to collect an abundant quantity of food; each plant muſt be enabled to tiller greatly, ſo as to produce a conſiderable number of ſtalks; and each ſtalk muſt be enabled to bear a fine long ear, well filled with grains to its very point.

" To effect the firſt of theſe requiſites, the field, after being thoroughly plowed and well harrowed, muſt be divided by furrows, the ſpaces between which may be of ſuch breadth as ſhall be judged moſt proper; for neither their precise width, nor the diſtance between the rows of corn, is yet fully determined; as will appear by the detail of the annexed experiments. In the middle of theſe ſpaces, which will be diſtinguiſhed by the name of *beds*, the wheat, or other grain, is to be ſown in one, two, or more rows. An inch will be ſufficient for the diſtance between the grains, length-ways of the row; though that may be ſomewhat leſs, if the ground be not very good for wheat; or, on the contrary, ſomewhat more, if it be excellent for that grain. By this diſtribution, each plant will find, in the intermediate ſpaces between the beds, and in the beds themſelves, a ſufficient extent of earth wherein to collect its neceſſary food; for thoſe intermediate ſpaces, which I ſhall call *alleys*, muſt be wide enough to admit of ſtirring the ground in them while the plants grow: but, to anſwer the ſecond and third intentions, it is of conſequence that theſe ſtirrings be performed at proper ſeaſons, becauſe each of them is to produce its particular effect.

"It is eſſentially neceſſary that the rows of corn be ſown very ſtrait; a circumſtance which, though it be attended with ſome trouble, ought not to diſcourage the husbandman, becauſe the great difficulty will be only the firſt time. After the ground has been once rightly ſown, it will be eaſy to continue in the ſame regular track every following year, without taking the precautions I am now going to mention.

"If the field be not very large, a furrow traced with a ſpade or pick axe, directed by a line ſtretched a-croſs the ground, will enable the plowman to guide the horſe that draws the drill; and he will take care to leave a proper interval between one furrow and another, if three rows are to be ſown.

"If the extent of ground be too great for the above method, poles or ſtakes may be ſtuck, five feet aſunder, at each end of the field, to guide the plowman, who, with a common plough, will trace ſmall furrows, by the help of which the horſe and drill may be properly directed.

"It will be right, if poſſible, to ſuit the direction of the furrows to the declivity of the land, that the water may drain down to the loweſt part of the field, where a ditch ſhould be dug to carry it off: and it will alſo be right, if weightier reaſons do not prevail, to make them length-ways of the field, that the leſs ground may be loſt by the ſpace which muſt be left for the plough to turn in."

The choice of ſeed, and the manner of ſteeping it in order to prepare it for ſowing, have been already noticed in the former Volume of this work[n].

"After the ſeed is put into the hoppers of the drill, the horſe which draws this inſtrument muſt be made to walk ſlowly in the furrow before traced by way of guide: and in order to drop as nearly as poſſible the intended quantity of ſeed, the outlet of the hopper muſt be proportioned to the ſize of the grain.

"As it will be ſomewhat difficult to manage the drill rightly at firſt, till the huſbandman becomes uſed to it; he ſhould look over his field as ſoon as the corn has ſprouted, and then drop by hand a few grains in the places where it may have failed.

"The land ſhould be ſown about the middle of September, or, at fartheſt by the end of that

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[n] *Vol.* I. *p.* 289, *and p.* 293, *&* *ſeqq.*

month: and it will be right always to try the goodneſs of the ſeed before hand, by ſowing fifty or an hundred grains of it in a fine mould, or moiſt ground, where it will ſoon appear whether they all riſe.

"Land which retains water ſhould be plowed once in October, when the weather is fine. In doing this, a furrow ſhould be firſt cut in the middle of the alleys, and then it ſhould be filled with the earth on each ſide, even ſo as to arch it up, and leave only a ſmall furrow on either ſide, cloſe to the beds, to drain off the wet, which would prove very prejudicial to the plants if it were to remain long near their roots. This looſening of the earth will alſo fit it for being mellowed by the winter's froſts; to which, however, care muſt be taken not to expoſe the roots of the corn, by leaving them too bare of mould. The moſt proper time for this ſtirring of the ground is when the plants have ſhot out ſome blades.

"The ſecond horſe-hoeing, which ſhould be given as ſoon as the hard froſts are paſt, that is to ſay, by the end of March, is intended to make the plants tiller; and will have this effect, if, after the earth near the rows has been ſtirred a little, that which was before laid up in the middle of the alleys be returned back to the furrows at their ſides. This earth, having been mellowed during the winter, will afford excellent nouriſhment to the plants now beginning to vegetate a-pace, and they will ſoon put forth their multiplied ſtalks.

"The third hoeing, which is the ſecond after winter, and is intended to ſtrengthen the ſtalks, ſhould be performed when the ears of the corn begin to appear. This culture, which is looked upon as the leaſt important of all, and is ſometimes even omitted without any great inconvenience, needs not be any thing more than a ſlight ſtirring of the earth, in which it will, however, be right to begin to hollow the alleys.

"The laſt ſtirring of the earth between the rows of corn is one of the moſt important; being that which makes the grains ſwell, and grow full bodied to the very point of the ear. The moſt proper time for this is when the ears begin to bloom: but as the corn is then high, only one furrow can be cut in the middle of the alleys, the earth of which ſhould be laid up to the ſtems of the plants on each ſide. The plough will hardly be able to paſs more than twice in this furrow, which ſhould, however, be made as deep as poſſible, in order to bank up the greater quantity of earth. By this operation, the now fallow allies are prepared for the next ſowing; for it is in the middle of them that the corn is to be planted the following year; and the now eared wheat is earthed up, to prevent it's being lodged, though, in general, corn thus cultivated is leſs apt to be beaten down, than that which is raiſed in the common way, becauſe the ſtraw of this, being more expoſed to the air, becomes harder, and acquires a firmer texture, eſpecially toward it's bottom. It is for this reaſon that a tufft of corn which ſtands quite ſingle, is ſcarcely ever beaten down by the weather.

"Theſe repeated hoeings of the earth will certainly be rewarded with a very plentiful crop, unleſs the ſeaſons prove extremely bad.

"When the corn is reaped, all poſſible care ſhould be taken not to trample upon the adjoining plowed ground.

"It is well known, that vigorous plants do not ripen their ſeeds ſo ſoon as thoſe which have been ſtinted in their growth. For this reaſon, the corn cultivated according to the principles of the new huſbandry, ripens later than in the common way, and ſhould therefore be ſown ſomewhat earlier.

"We will now ſuppoſe that the crop is reaped, and that the ſame field is to be ſown again with wheat the next year, and every year after, as it may be; becauſe the rows of corn are placed each time in the middle of the former alleys, which have been plowed during the whole year without producing any thing. Thus, the only difference between this new method and the old huſbandry is, that inſtead of reſting, or fallowing, a whole field, whilſt another whole field is under corn, and each of them is ſeparate from the other; the fallow here is in the ſame field as the corn; being interpoſed by means of alleys, which are the part reſted, between the beds, which are the part cultivated: but there is this great advantage here, that the ſtirring of the earth in the allies, which are not planted, not only prepares the ſoil admirably for being ſown the next year, but invigorates the plants actually growing in the beds.

"If it be thought proper to dung the allies, in order to prepare them for the reception of the ſeed, the dung, which ſhould be thoroughly rotten, muſt be laid in the bottom of the deep furrow before made in the middle of them, and there covered with the earth which was thrown up towards the rows of wheat. If the land does not want dunging, this deep furrow is filled up without it; and this ſhould be done immediately after harveſt, that there may be time to give the ground another ſtirring, which need only be a ſlight one, before the ſowing of the rows which are now to be in the middle of the former alleys; and the alleys of this year will be in the place of the laſt year's ſtubble.

"Though land cultivated according to the principles of the new husbandry does not require ſo much dunging as that which is managed in the old way, yet this manure will always help to enrich the ſoil, eſpecially if it be uſed in the manner here directed. By being thoroughly rotten when it is laid in the furrow, and there covered over immediately after harveſt, it will have time to mellow and diffuſe it's influence, and not be apt afterwards to choak up the ſhares of the drill: an inconvenience which does not happen with pigeon's dung, which therefore need not be ſtrewed till the ground is plowed for ſowing.

" It is farther obſerved:

" 1, That if dung be uſed for the ſecond year's crop, very little of it will ſuffice: becauſe it need only be laid in the bottom of the furrows.

" 2, That there can hardly be any occaſion for dung this ſecond year, becauſe, if the earth of the beds in which the wheat grew was good, that of the alleys, of the ſame ſoil, muſt be ſtill better, by reaſon of it's having been fallowed and well tilled.

" 3, That the ſecond year's wheat is placed in a moſt advantageous ſituation, it's roots having a depth of twelve or fifteen inches to extend themſelves in, by means of the furrow which was in the middle of the alley. For this reaſon, corn ought to thrive beſt in thoſe lands which have been longeſt cultivated according to the new husbandry.

" The earth in the alleys is to be horſe-hoed during the ſecond year, in the ſame manner, and at the ſame ſeaſons, as in the firſt.

" This frequency of hoeing ought not to be objected to; for the labour of the firſt hoeing, to make the furrows on each ſide of the rows, and lay the earth up in the middle of the alleys, cannot be great; and the ſecond only returns that earth into thoſe furrows: the third, is only to ſtir the ſurface of the ſoil: the fourth and laſt, is to make the deep furrow in the middle of the alleys, and bank up the rows of corn on each ſide with the earth taken out of it: ſo that neither of theſe operations ever extends to above a third part of the ground, at any one time.

"The whole field might indeed be plowed up after harveſt: but I would adviſe the huſbandman not to touch the ſtubble then, becauſe the rows of that will help him to guide the drill in ſtrait lines, and the yet un-rotten ſtraw might be apt to clog the ſhares of the drill, ſo as to prevent their working properly. However, if the ſtubble be very ſhort, this caution becomes the leſs material, and the whole field may then be plowed: though ſtill it will be neceſſary to plow it again in October, in order to make drains to carry off the wet.

"It is almoſt needleſs to obſerve, that all the operations of which I have been ſpeaking muſt often be performed either a little earlier, or ſomewhat later, according as the year is more or leſs forward; and that it will always be neceſſary to wait till the ground is dry enough to be plowed without danger of it's clodding: a circumſtance which varies greatly, according to the nature of the ſoil."

The above are M. Duhamel's directions for what may be properly called the horſe-hoeing huſbandry, and the moſt judicious execution of Mr. Tull's improvement. He afterwards[o] gives the ſubſtance of a *memoir* from M. de Lignerolle, propoſing an alteration in the management of the land cultivated in this way: but as he divides it into ridges, inſtead of beds, the benefit which the corn reaps from hoeing the alleys is here loſt; becauſe the breadth of his ridges is ſuch, that the plants on the ridge under crop, if we except the outmoſt rows, cannot reap any advantage from the plowings given to the fallow ridge.

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[o] *Eléments d'Agriculture, Tom.* I. *p.* 471 — 483.

I ſhall, however, give a conciſe account of what M. de Lignerolle ſays upon this ſubject.

"The field, after being previouſly brought to a proper tilth, is diſpoſed in beds, which are formed by gathering the land up to the middle of each bed, by as many turns of the plough as are neceſſary for that purpoſe, in the manner which our farmers would call four or five-bout lands. He then ſows the alternate ridges in the following manner. He drops the ſeed into the two traces between the earth thrown up by the plough in the middle of the bed, and covers it with the earth turned up on each ſide. This ſeed will, by this means, come up as one row. More ſeed is then ſown in the two furrows on each ſide of the former, and covered as before by another turn of the plough; and thus the wheat is diſtributed in rows, on each ſide, till the whole bed is ſown.

"The ſeed which is ſown in the middle of the ridge ſhould thrive well, as it has a deep bed of looſe mould to grow in; and the ſame may be ſaid of the next rows on both ſides: but, the earth being ſhallower at the ſides of the ridges, the outmoſt rows will not ſucceed ſo well, as is generally found at harveſt; for they are much the weakeſt. However, this is in ſome degree remedied by the aſſiſtance which they receive from the plowing of the fallow ridges.

"The furrow between each ridge ſerves as a drain during the winter; for which reaſon it would be improper to fill it up, by plowing the fallow ridge, during that ſeaſon. But this need not prevent turning the middle of that ridge over toward the furrow; becauſe a ſpace may eaſily be left on each ſide of it, to hinder the earth from falling into the draining furrow, which may be filled in the ſpring, when the laying of freſh earth to the roots of the outer rows will help to compenſate for the ſhallowneſs of the ſoil where they are ſituated. The fallow ridge is plowed frequently during the ſummer, to keep it in good tilth and free from weeds. If the farmer is afraid of bringing the plough too near to the rows of corn when it is grown tall, the edges of the fallow furrow may be ſtirred with the *Cultivator*, which only looſens the earth, but does not remove it from it's place. In the ſecond year, the fallow ridge is ſowed as directed for the firſt, and the ridge which bore the former crop now becomes a fallow, which is to be treated in the manner before mentioned.

ARTICLE II.

Of the Inſtruments uſeful in, or peculiar to THE HORSE-HOEING HUSBANDRY.

SEVERAL very ingenious and intelligent gentlemen having deſired a particular deſcription of M. de Chateauvieux's Drill-plough, which is univerſally allowed to be the moſt perfect ever yet invented, though I declined giving it in the former volume of this work, for the reaſons there aſſigned[a]; I ſhall, in conſequence of their requeſt, copy here* that truly patriotic huſbandman and excellent magiſtrate's accurate detail of this hitherto unequalled inſtrument for the regular ſowing of corn, with his own previous introduction, which, if duly conſidered, will remove many of the objections commonly alledged againſt it.

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[a] *p.* 332.

* From M. Duhamel's *Culture des Terres*, *Tom.* III. *p.* 214.

Deſcription of M. DE CHATEAUVIEUX's DRILL-PLOUGH, *and of it's manner of working.*

M. DE CHATEAUVIEUX's ADVERTISEMENT.

"WHEN I firſt ſet about conſtructing this drill plough, my deſign was to make an inſtrument which ſhould diſtribute the grains of corn one by one, at the diſtance of ſix inches from each other. I attained this preciſion; but ſoon perceived that it was not the only thing requiſite, or even ſo neceſſary as I had imagined.

"I could, indeed, make my drill diſtribute ſome grains more than it did in it's firſt ſtate: but I plainly found that the quantity of ſeed would not yet be ſufficient to produce a proper number of plants; eſpecially as it muſt not be expected that every ſeed will grow; 1, becauſe, whatever care be taken in chooſing the ſeeds, there will always be among them many which will not ſprout at all; 2, becauſe a great number of them will be deſtroyed by inſects, either before they vegetate, or ſoon after they ſpring up; and 3, becauſe the winter's cold will frequently deſtroy ſeveral of the young plants, and greatly weaken others.—Experience taught me, that, to guard againſt the effect of theſe caſualities, it was neceſſary to ſow more ſeed than I did at firſt.

"To this end, and that I might be enabled to increaſe the quantity to whatever degree ſhould be found moſt proper, I enlarged the cavities of my cylinder, ſo that I can now ſow either more or leſs ſeed, with equal eaſe, by means which will be explained in the deſcription of this inſtrument.

"Each of theſe cavities in the cylinder of my firſt drill-plough could contain but one grain of corn; but in the preſent, they are large enough to hold three or four, which, tho' they touch one another there, are ſo ſeparated when they fall from thence, and in their paſſage through the pipes, that they drop at diſtances from each other in the furrow; for they are not all turned out of the cavities in the cylinder at the ſame time: beſides which, I have obſerved, that the ground upon which they fall is always more or leſs uneven, and that this circumſtance conſequently contributes effectually to ſeparate them.

"I confeſs that the deſcription which I am going to give is very long, and that this, together with the ſight of ſo many figures as are here repreſented, may, at firſt, make people think that my drill is a very complicated machine, and that this complication muſt render it very defective: but I beg of them not to give way to this prejudice, and to ſuſpend their judgment, till they have ſtudied the inſtrument thoroughly; after which, I hope they will be ſenſible that all its mechaniſm is employed only to procure the movement of the axis *Fig.* 39. *Plate* III, and the play of the valves *a b c d e f*, *Fig.* 53, *Plate* IV. I even flatter myſelf that it will be deemed a ſimple inſtrument, by thoſe who rightly conſider how few of it's parts are moved; a circumſtance which prevents it's being put out of order in working. The great quantities of land which were ſowed laſt autumn*, with perfect ſucceſs, ought to remove the diffidence of thoſe who may ſtill incline to doubt whether this drill will always and regularly perform equally well.

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* In 1753.

" It will perhaps be objected, that the expence of making this drill-plough is too great, and that numbers of farmers, who have not much land, may not be able conveniently to purchaſe it.

" It is very true that if this inſtrument could be conſtructed for a ſmall price, the benefits reſulting from it would be the more extenſive: but it muſt alſo be allowed that this objection does not hold good with reſpect to all farmers, or to gentlemen who keep ground in their own hands, Theſe will ſoon be repaid the expence of ſuch a drill, by the ſaving of ſeed: and as to the poorer ſort, who have, for example, but ten or twelve acres of arable land, the expence will be but trifling, if four or five neighbours, in that caſe, join to purchaſe ſuch a drill, which will be more than ſufficient to ſow all their ground.—Or, each pariſh may come to an agreement, that he who can afford to buy ſuch a drill, may let it out for ſo much an acre: a method which would be advantagious to all; but particularly to thoſe who, by uſing it, would ſow their land with very little charge.

" But I think, and hope, that when the great advantage of uſing this inſtrument is known, no husbandman will be without it merely becauſe of the price; as this conſideration cannot ever outweigh the benefits which will accrue from it in all reſpects, by leſſening the expence of every article in the operation of ſowing, and by the farther emoluments which will be reaped at harveſt.

" I therefore, in conſtructing this inſtrument, paid leſs regard to the price which it might coſt, than to the means of rendering it very ſolid, by a firm aſſemblage of all it's parts; which was eſſential, in order to prevent the frequent accidents it would otherwiſe have been expoſed to, in the hands of ignorant peaſants, who have no idea of handling things gently, and are ſtill leſs capable of repairing any miſchief done to a very nice machine.

At the ſame time that I ſtudied ſtrength and ſolidity in the conſtruction of this inſtrument, it was not leſs neceſſary to take particular care that it ſhould execute well and regularly the purpoſes for which it is intended, both with reſpect to the manner of it's diſtributing each grain, and to the movement of the axis *Fig.* 39, which is always in motion from the moment that the horſe ſtirs, ſo that the ſeed runs inceſſantly.

In deſcribing this inſtrument, I have firſt given a general idea of it's make and manner of working, that the reader may be thereby enabled the more eaſily to underſtand the ſubſequent minute deſcription of all it's parts, with their relation to, and connection with, each other. The method of uſing it will then follow.

GENERAL IDEA OF M. DE CHATEAUVIEUX'S DRILL-PLOUGH.

PLATE I.

A (*Fig.* 1,) is a wooden box, or *hopper*, whoſe bottom is at the height of the line *F G*. This hopper has four feet, two of which are ſeen at *k* and *l*. Theſe four feet, which may be called tenons, are fitted into four mortiſes in the table *H L*. The bottom *F G* of this hopper reſts immediately upon the ſeed-box *B*, which is made of thin plates of braſs, and is placed between the bottom of that upper box or hopper, it's two ſides which have the four feet, and the table *H L*. *B* is the front of this ſeed-box. The corn drops through a hole in the middle of the bottom of the hopper,

hopper *A*, into the ſeed-box *B*. This ſeed-box *B* contains a braſs cylinder, which traverſes it, and is pierced by and fixed to an iron axis *M P*, at the two ends of which are firmly faſtened two pullies *Q* and *P*. The two pivots of the axis are ſupported by two ſtandards, one of which is ſeen at *M H*, and a part of the foot of the other at *L*. Theſe two ſtandards are fixed to the two ends of the table by two keys, like thoſe of a turner's lathe.

The table upon which all theſe pieces reſt, is itſelf, at its two ends, ſupported by, and faſtened to the two beams *T V*, *R S*. Theſe two beams are fixed in parallel lines, by a traverſe *X Z*. In the middle, *U*, of this traverſe, is pinned the end of another piece of wood, which paſſes from thence under the table, in a parallel direction with the two beams, and upon which alſo this table is faſtened by two ſcrews.

This inſtrument has three exactly ſimilar ſhares, *D*, *K*, *e*. Two of theſe ſhares, *K*, and *D*, are faſtened to the two beams, at *I* and *p*; by a tenon and a peg, and the third is faſtened in the ſame manner, towards *U*, to the piece which runs parallel to the beams. Each of theſe ſhares is covered, at the bottom, with a plate of iron, *N*, *E*, *C*; and the point of one of them, ſuppoſed to be in the earth, is ſeen at *Y*.

The harrow is compoſed of three pieces of wood *q O*, *O W*, *W n*, jointed together by mortiſes and tenons at *O* and *W*, and of two ſimilar iron teeth *W z*, *O R*. Theſe two teeth are faſtened to the harrows by the ſcrews *W* and *O*, and the harrow is faſtened to the traverſe *X Z* by two hinges, near *q* and *n*. Upon the two beams are alſo faſtened by two ſcrews, at *m* and *e*, two ſquare ſprings *m i q* and *e Z n*, of which the two ends *q*, and *n*, preſs upon the harrow, to make it's two teeth enter into the earth.

The fore-carriage is compoſed of two ſimilar and parallel pieces *V r*, *S s*, upon which is faſtened the ſpring-tree bar *r s*, and the axle-tree *u t* of the two wheels: The drill, (of which the manner of working will be explained hereafter) reſts upon this fore-carriage, whenever there is occaſion for it's ſo doing, by means of a wooden bar *d x*, one of the ends of which, towards *d*, paſſes through two belts which are faſtened to the table, and of which only one is ſeen here. The other end *x* of this bar, reſts upon the middle of the axle-tree of the fore-carriage, between two pins driven into the upper part of that axle-tree. The fore-carriage is likewiſe faſtened to the drill by hooks and rings, as at *V* and *S*.

At *t* and *u* are two pullies, which are faſtened to the ſpokes of the wheels by three or four ſcrews. The pullies *Q* and *u* are encircled by a thong of leather, of the ſame breadth as the grooves of the pullies, and of which the two ends are buckled together, like a garter. The two other pullies *P* and *t* are encircled in the ſame manner by another ſimilar thong:

Manner in which the DRILL *works.*

The ſeed being put into the hopper *A* (*Fig.* 1), the whole machine being drawn by the horſe harneſſed to the ſpring-tree bar *r*, *s*, and guided by the ſeedſman, who holds the two handles; then the three ſhares *D*, *K*, *e C*, open each of them a furrow, and at the ſame time the pullies *u*, *t*, by their turning, turn, by means of the thongs, the two other pullies *Q*, *P*, and conſequently likewiſe the cylinder, which is in the box *B*, and which, in turning, diſtributes the ſeeds equally into three pipes which come out at the bottom of the ſeed-box. This diſtribution of the ſeed is performed by a mechaniſm which cannot be repreſented here, but will be particularly explained hereafter. The ends of theſe pipes are ſeen here at *a* and *b*. Theſe pipes *a* and *b* drop the ſeed into two other pipes *d* and *f*. The pipe *a* tranſmits it's contents into the pipe *d*, which terminates behind the ſhare *D*, at *h*, where it depoſits the ſeeds in the furrow made by this ſhare. In the ſame manner, the end of the pipe *b* of the box conveys the ſeed which paſſes through it into the pipe *f*, which terminates at *g*, behind the ſhare *K*. And likewiſe in the ſame manner, the third pipe of the box, which cannot be ſeen in this figure, empties it's contents into a third pipe, of which part is ſeen here at *v*, *y*, and which terminates behind the third ſhare *e*, *C*, The two teeth of the harrow, paſſing afterward each of them between two of theſe furrows, cover the ſeeds which have dropped into the three furrows.

According as a ſcrew *B*, in the fore part of the box is turned more or leſs from the right to the left, or from the left to the right, a greater or leſs quantity of ſeed drops into each furrow, by a means which will be explained hereafter. But ſo long as this ſcrew remains in the ſame ſituation, the quantity of the ſeed that is dropped will be conſtantly the ſame.

To render the deſcription of this firſt figure the more diſtinct and intelligible, ſome things are paſſed over here, which will be ſpoken of hereafter, and among others two traverſes which faſten together the two pieces *V r*, *S s*, of the fore-carriage. Alſo the box *B* is here made larger than it ſhould be according to the deſcription which will be given of it, in order that the pipes *a* and *b*, *d* and *f* might appear the more diſtinctly. For the ſame reaſon alſo, the out-lets of the pipes *a* and *b* are not here repreſented as let into the mouths *d* and *f* of the two other pipes, as they ſhould be in fact.

In the following deſcriptions, that part of a piece which immediately faces the horſe, is always called the fore-part of the piece, excepting only the piece named the rake, and its valves, in ſpeaking of which the contrary rule is obſerved. But, every where, the right or the left ſide of a piece, is to be underſtood as of the ſame ſide of the horſe.

When a machine is to be made from drawings, thoſe drawings, eſpecially when ſmall, cannot, by their ſcale, point out preciſely the exact dimenſions of every nice, and oftentimes very important, piece, ſo as to enable a workman to conſtruct it perfectly. To remedy this defect, all the meaſures of every piece, and their connection with each other, are here particularly ſpecified in the written deſcription, which is to be looked upon as a ſurer guide than the meaſures reſulting from the engraved figures: and to render this ſtill more certain, the weight of the niceſt pieces is alſo given.

Deſcription of the two Beams which ſupport the Table and the Hopper. Pl. I, & II.

The two *Beams T V*, *R S*, (*Fig.* 1,) are repreſented as if ſeen from above at *a*, *b*, *d*, *e*, (*Fig.* 2.) They are exactly ſimilar. Each of them is 3 feet 5 inches and a half long, two inches and five ſixths wide (for example from *b* to *c*), and 1 inch five ſixths thick. All their ſides are at right angles to each other.

Theſe two beams are joined by a traverſe *f h* (*Fig.* 2.) and *X Z* (*Fig.* 1.). This traverſe is 2 inches and five ſixths wide, meaſuring it horizontally,

tally, 1 inch and three twelfths thick, and 1 foot and a half long, excluſive of two tenons, one at each end, by which it is mortiſed into the two beams, which are parallel to each other. The upper ſurface of theſe beams, and that of their traverſe, are exactly even. The diſtance from *c* to *f* (*Fig.* 2.), is 1 foot 11 inches and a quarter; and the ſame from *i* to *h*.

Underneath each beam, and at the diſtance of 5 inches from the extremity *a*,(*Fig.* 3,), an iron pin, ſeven twelfths, or two thirds of an inch in diameter, projects to the length of 4 inches and one third. One of theſe pins is ſeen at Δ (*Fig.* 1.). It's other end is driven faſt into the middle of the breadth of the under ſurface of the beam, from which it projects perpendicularly. Theſe two pins are to enter into two holes in the axle-tree of the hind-carriage, which will be ſpoken of hereafter.

Of the two Handles.

Two *Handles*, *k n*, *l m*, (*Fig.* 2), are faſtened to the two beams, each of them by a tenon *d*, (*Fig.* 3), five ſixths of an inch thick, which paſſes through the beam, and is ſecured underneath it by a wooden pin or peg *d*, about half an inch in diameter. Each handle is likewiſe ſupported upon the beam by a wooden prop *p l*, which is ſeen at *R* and *T* (*Fig.* 1.) Each of theſe props is three quarters of an inch in diameter, and is driven very tightly into the handle and the beam, at *p* and *l* (*Fig.* 3,), ſo as to paſs quite through them. The upper end *c* of theſe props is ſeen at *V* and *X* in *Fig.* 2. From the extremity *k* of the handle (*Fig.* 2 and 3,), to the extremity *a* of the beam, is 1 foot and one third of an inch, and the diſtance is the ſame from *d* to *l* in *Fig.* 2. The breadth and thickneſs of the lower end of the handles at *g k* (*Fig.* 2 and 3), is nearly the ſame as the breadth of the beams, upon which they reſt: but they leſſen by degrees from *k* to *n* (*Fig.* 2 and 3), and are rounded off, in ſuch manner that the diameter of their upper end *n* is but 1 inch and a third.

With reſpect to their poſition, they form, with the beams, an angle of 40 degrees, as at *c k a* (*Fig.* 3). The handle is nearly ſtrait from *k*, to about a third part of it's length, and from thence it bends more and more downward, to it's end *n*, which is perpendicularly 2 feet higher than the upper ſurface *k m* of the beam. This height is expreſſed by the pricked line *n m*. The ſpace between the handles likewiſe increaſes with their length, ſo that, at their ſmalleſt ends, the diſtance from the outſide *m* of the one, to the outſide *n* of the other (*Fig.* 2), is 1 foot 8 inches and a half, and each of them is equally diſtant from the middle line *o p*.

Theſe two handles are faſtened to each other by a traverſe *q r*, which is repreſented in *Fig.* 1, but is expreſſed here only by two pricked lines, in order to ſhew a piece which is under it, and which will ſoon be ſpoken of. This traverſe is 1 inch and five ſixths broad, and two thirds of an inch thick. It's ends, being tenons, are let into mortiſes in the beams, and faſtened there by wooden pins, at *q* and *r*. One of theſe ends appears at *q* (*Fig.* 3). From the middle of the length of this traverſe hangs an iron hook, as in *Fig.* 1. This hook is about a quarter of an inch thick, and 5 inches and a half long, from it's extremity *e* (*Fig.* 3), to it's other end which is faſtened to the traverſe. The lower end of this hook is put through a ſmall ring faſtened to the harrow between the ſcrews of the two teeth, and ſerves to hold up the harrow when the drill is placed upon it's hind-carriage, in order to be removed, as will be ſaid hereafter. The traverſe is fixed in the handles at the diſtance of 13 inches from their extremity *k* (*Fig.* 2 and 3). The two handles, which the ſeedſman holds in his hands by their ends *m n* (*Fig.* 2 and 3), ſerve to direct the drill.

Of the Harrow.

The harrow is compoſed of 3 pieces of wood *s t*, *y x*, *t x*, (*Fig.* 2), and of two teeth faſtened to this laſt. Theſe 3 pieces are repreſented at *q O*, *O W*, and *W n*, and the two teeth at *W z* and *O R*, in *Fig.* 1. The two pieces *s t*, *y x* (*Fig.* 2), are each of them faſtened to the traverſe *s y* by an iron hinge, in ſuch manner that the upper ſurface of the ends *s* and *y* of theſe two pieces is exactly level with the upper ſurface of the traverſe *s y*. Their two other ends, *t* and *x*, are terminated by a tenon which is pinned into the ends of the traverſe *t x*. The upper ſurface of theſe three pieces *s t*, *y x*, *t x*, is perfectly even.

The two pieces *s t*, *y x*, are each of them 1 foot 3 inches long, from the end *s*, to the traverſe at *t*. They are 2 inches and one third broad, meaſuring over their upper ſurface, and 1 inch and two thirds thick. The fore-end of theſe pieces towards the hinge makes an angle of about 65 degrees, with the upper ſurface, as is repreſented in the profile (*Fig.* 4,) where the lines *d a*, *a b*, expreſs this angle. This ſlope is made, in order that the harrow may the more eaſily preſs upon the ground, by moving on it's hinges; and for the ſame reaſon all friction between the ſides of the harrow and thoſe of the beams is avoided, by leaving an interval of about one ſixth or one quarter of an inch between them. The lines, or edges *t s*, *x y* (*Fig.* 2,) are parallel, and the diſtance between them is 1 foot and five ſixths of an inch. The traverſe *t x* is two inches and nineteen twenty-fourths wide, and one inch and two thirds thick.

In the middle of the breadth of the upper ſurface of this traverſe, and cut perpendicularly to that ſurface, are two ſquare holes *M* and *N*, diſtant from each other 7 inches and a half, from the centre of one to the centre of the other, and both equally diſtant from the middle line *b p*.

Of the teeth of the Harrow.

In theſe two holes *M N* in the traverſe of the harrow are faſtened, as will ſoon be ſeen, two iron teeth, perfectly alike, ſo that it will be ſufficient to deſcribe one of them. This tooth is ſhaped almoſt like the head of a lance, if we ſuppoſe it's two ſides to be bent towards each other, ſo as to form a kind of groove or channel. Theſe two ſides, or fins, are ſeen in perſpective, ſideways in *Fig*. 5, behind in *Fig*. 6, from above, and from before, in *Fig*. 7.

The ſhank *b d* (*Fig*. 5,) is 5 ihches and a half long, from it's riſe at *a b*, to it's end *d*; and three quarters of an inch thick at *a b*, where it is made ſquare. This thickneſs is increaſed a little at *c*, in order to form the ſhoulder repreſented at *a b* (*Fig*. 7). The diſtance from *a b* (*Fig*. 5), to this ſhoulder *c*, is 3 inches. The ſquare thickneſs of the ſhank, from *c* to *n*, is half an inch; which is likewiſe the ſize of the holes *M N* (*Fig*. 2). The reſt of the ſhank is round, and half an inch in diameter. It's upper end is a ſcrew, fitted to receive a nut about half an inch thick and a little more than an inch ſquare. The point *e* does not vary from the direction of the ſhank, either to the right or the left, as appears by *Fig.* 6: but the ſide *b e* (*Fig.* 5,) bends a little forward, ſo that the point *e* advances 1 inch and a quarter beyond the pricked perpendicular *n b f*. The upper and outer extremities *c* and *f* of the fins *Fig.* 7, are 2 inches and one twelfth diſtant from each other, and equally diſtant from the middle of the ſhank. The width of each fin, in this part, from *s* to *f*, or from *s* to *c*, is 1 inch and a half. From thence they leſſen by degrees down to their point. The edges of theſe ſides, or fins, are almoſt ſharp, but their thickneſs and ſtrength increaſe towards their back.

The two teeth of the harrow are placed exactly in the middle of two parallel lines ſuppoſed to be drawn from the point of the ſhares; by which means theſe teeth will enter into the ground at equal diſtances from the ſmall furrows made by the ſhares, into which they will throw back the quantity of earth neceſſary to cover the ſeeds perfectly.

As to the poſition of theſe two teeth, they are faſtened in the two holes *M* and *N* of the traverſe *t x* (*Fig.* 2,) as is repreſented by the perſpective view of them in *Fig.* 8. The ſhank of each tooth is run through the holes in the traverſe *x t*; it's ſhoulder is thruſt up cloſe to the under ſurface of this traverſe; and a nut, under which is placed a very thin plate of iron, fixes it at the top. The back and point of theſe two pieces ſhould face exactly the fore-part of the drill.

Hinges of the Harrow.

To return to the hinges *s* and *y* (*Fig.* 2,) which are exactly alike, and which are ſeen at *q* and *n* in *Fig.* 1. Their breadth is 1 inch and two thirds, during their whole length, from *v* to *f*

(*Fig*. 2). The joint *s*, of this hinge, is half an inch in diameter. The claw, from the joint *s* to *f*, is 2 inches and a quarter long, and is faſtened to the traverſe *f b* by a thumb-ſcrew repreſented in perſpective in *Fig*. 9, and which ſcrews into a nut *a b*, which is faſtened to the bottom of the traverſe, by two nails. This ſcrew (*Fig*. 9), is one third of an inch in diameter. It is ſcrewed down, by means of a correſponding ſcrew in the nut under the traverſe, till it's ſhoulder *c n*, which is two thirds of an inch in diameter, preſſes upon the claw of the hinge: for which ſee alſo *Fig*. 4. The length of the other claw of the hinge *s v* (*Fig*. 2), from the joint *s* to it's end *v*, is 4 inches and a half. The thickneſs of each claw towards the joint, is a quarter of an inch, and from thence that thickneſs leſſens by degrees to the end *v*. The claw *s v* is faſtened to the piece *s t* by two flat-headed ſcrews.

Spring of the Harrow.

Upon this claw, and between theſe two ſcrews, preſſes the end *B* of a ſpring *A z*, which forms an angle at *A*, and is faſtened to the beam *a b*, between *D* and *z*, by two flat-headed ſcrews, of which the laſt *D* is 2 inches and a half diſtant from the end *z* of the ſpring. Theſe two ſprings are ſeen at *m i e Z n* in *Fig*. 1. The length of this ſpring from *z* to *A* (*Fig*. 2.) is 13 inches and a half, and from the angle *A* to *B* 2 inches and a quarter. It's breadth at *z* is 1 inch and a half; at *N* it is 1 inch and one twelfth; and at *B* it is thirteen twenty-fourths of an inch. It's thickneſs at *z* is five twenty-fourths of an inch, and from thence that thickneſs diminiſhes to *A*, where it is but one ſixth of an inch. The part *A B* increaſes in thickneſs from *A* to *B*, where it has a head, which alone preſſes upon the claw of the hinge between the two flat-headed ſcrews. This part of the ſpring, with it's head, is repreſented plainly, in perſpective, in *Fig.* 10. When this ſpring is in it's ſtate of reſt, the whole of it's under ſurface from *N* to *z* (*Fig.* 2), lies exactly flat upon the upper ſurface of the beam. The end *z* of this ſpring is 15 inches from the end *b* of the beam *a b*. Theſe ſprings ſhould be made of good well-hammered ſtuff, prepared like that which is uſed for the ſprings of coaches; by which means they will have a body, and not be ſubject to break or bend. If they appear to be too weak, they may be placed a little farther from the joint of the hinge, in which caſe they will the better preſs the teeth of the harrow down into the ground.

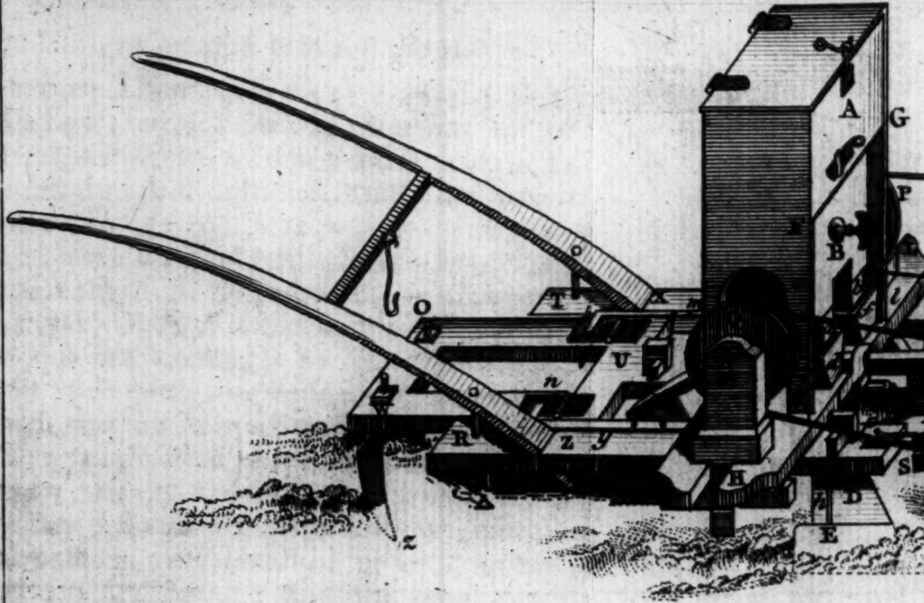
Connection of the Beams with the Table and the Shares.

The thickneſs of a quarter of an inch is taken off from the upper ſurface of each of the two beams, from *z* (*Fig.* 2), immediately adjoining to the end of the ſpring, to *Q*, in the one; and from *E* to *F* in the other; being, in length 8 inches and two thirds. In theſe lowered ſpaces is placed the table, which will ſoon be ſpoken of, and of which the extent is here indicated by pricked lines. This table is ſeen at *H* and *L* in *Fig.* 1. It is faſtened to the beams, by four ſtrong flat-headed ſcrews, at *z*, *I*, *G*, and *H*, *Fig.* 2, and is ſeen in profile in *Fig.* 3, *Pl.* II, at *i* and *r*. This table reſts likewiſe upon a piece *K L Fig.* 2, of which the end *K*, being a tenon, is pinned into the middle of the length of the traverſe *f h*; as is alſo ſeen at *U Fig.* 1. This piece *K L* (*Fig.* 2), is 2 inches and five ſixths broad, meaſuring it horizontally, and 1 inch and five ſixths thick. It's length is ſuch that it's end *L* reaches, at moſt, no farther than edge *Q F* of the table. At the end of this piece appears a ring, which is faſtened under it, and of which the deſcription and uſe will be ſeen hereafter. The upper ſurface of this piece *K L*, from *K* to *Y*, is level with the upper ſurface of the two beams, and the traverſe *f h*: but from *Y* to it's end, a quarter of an inch is taken off from it's thickneſs, in the ſame manner as from the oppoſite parts of the two beams, to fit it for the reception of the under ſurface of the table. A ſide view of this is given in *Fig.* 11, where *a b* is the profile of this ſurface, which, from *a* to *b*, is level with the ſurface *d a* of the traverſe, and from *b*, to it's end *c*, is a quarter of an inch lower, that the table may reſt upon it.

In the middle of the breadth of the upper ſurface of this piece *KL* (*Fig.* 2), and perpendicular to that ſurface, a mortiſe *P* is cut quite through it, to receive the tenon which is ſeen at *U*, *Fig.* 1. This mortiſe is, throughout, 2 inches long and 1 inch wide. It's end *P* (*Fig.* 2) is 3 inches and eleven twelfths diſtant from the traverſe *f h.* The two beams are pierced in the ſame manner by two ſimiliar mortiſes *Q* and *R*, of which the ends *Q* and *R* are 1 inch and eleven twelfths diſtant from the ſide *S T* of the table. The tenons which paſs through theſe two mortiſes are ſeen at *I* and *p* in *Fig.* 1. Theſe three mortiſes are to receive the tenons of three exactly ſimiliar ſhares, of which the following is the deſcription. Theſe three ſhares are ſeen at *D*, *K*, and *e*, in *Fig.* 1.

Of the Shares. Pl. II.

The ſhares are cut out of a plank, and *Fig.* 12 repreſents one of their two ſurfaces. The lines which limit this ſurface are perpendicular to each other, excepting *i d.* The line *d c* is 6 inches long



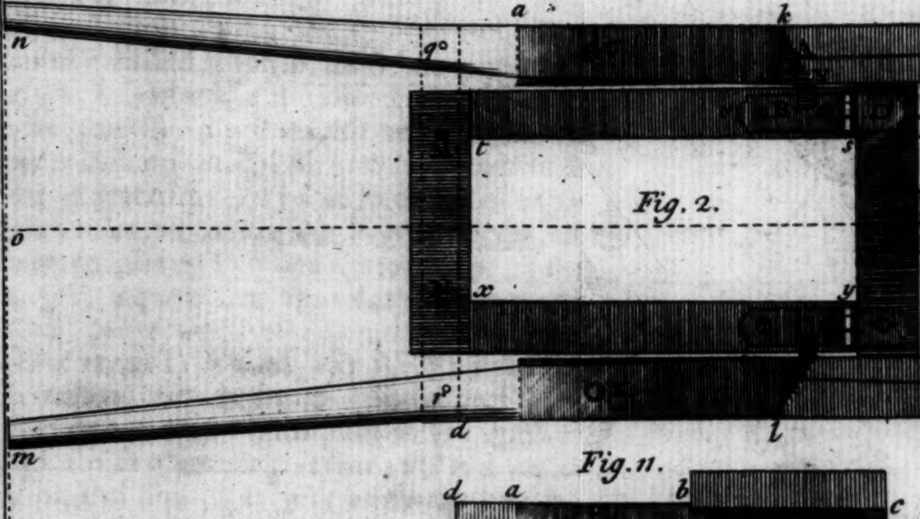
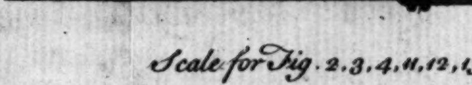


Fig. 2.

Fig. 11.



Scale for Fig. 2. 3. 4. 11, 12, 1

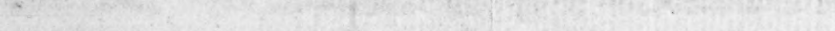


Fig. 1.

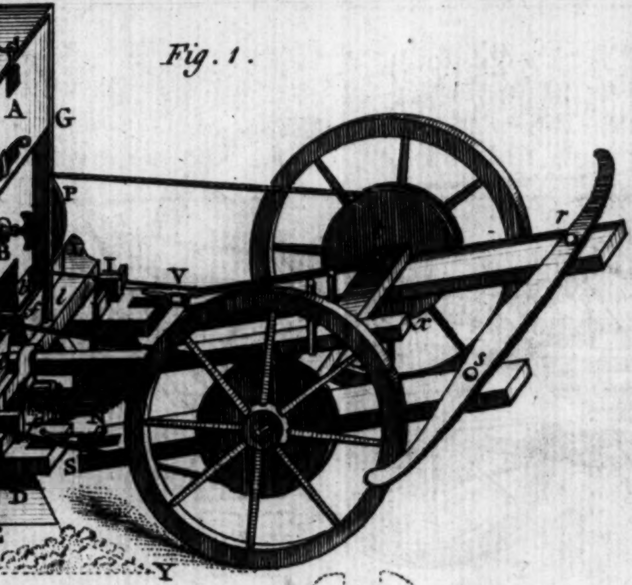


Fig. 4.

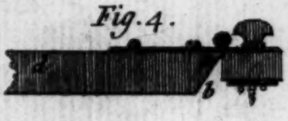


Fig. 5.

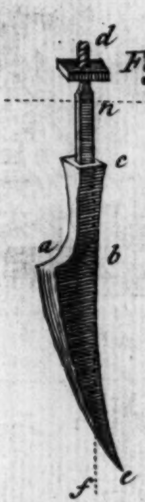
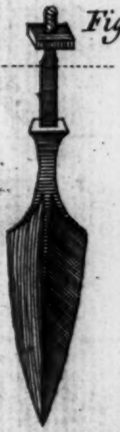
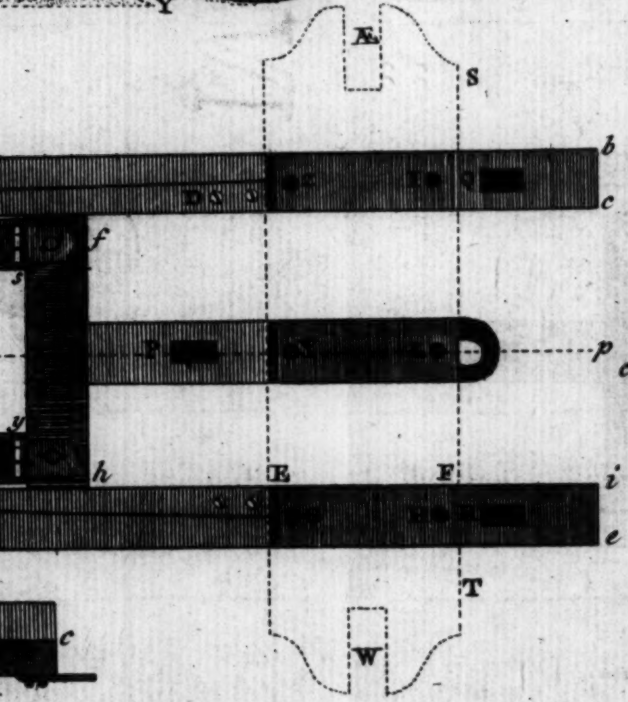


Fig. 6.





4,11,12,13,14,16,17. 20, 24, 85

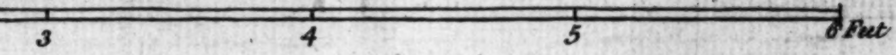


Fig. 7.

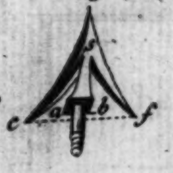


Fig. 8.

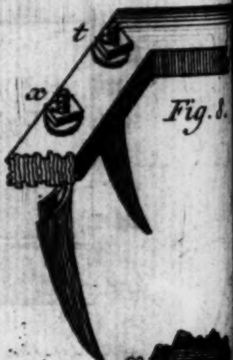


Fig. 9.

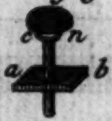
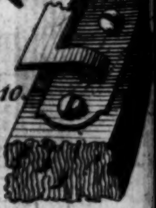


Fig. 10.



long; *c f*, 9 inches; *f g*, 2 inches and a quarter; *g l*, 5 inches and a half; *l m*, 2 inches; and *h i*, half an inch. This plank is every where an inch thick, except at the edge *e d*, where it forms an acute angle, as at *b*, *Fig.* 13, which repreſents the bottom of the plank *c d* (*Fig.* 12). The part *g l*, in which is the hole *k*, is the tenon which enters into the mortiſes *P*, *Q*, *R*, (*Fig.* 2,) before deſcribed. *Fig.* 14 repreſents the top of this plank, and of it's tenon.

Fig. 15, is a perſpective view of an iron ſhare which is fixed under the plank, as in *Fig.* 17. It's point (*Fig.* 15) extends from *e h* to *f*. It's ſole, which extends from *c b* to *a c*, and the ears *a b*, *c d*, are all of one piece. *Fig.* 16 repreſents a geometrical plan of this ſhare, in which *d f*, and *g h*, are the places from whence the two ears ariſe.

The length of the point, from *e b* to *f* (*Fig.* 15), and from *a b* to *c* (*Fig.* 16), is 4 inches. It's height towards *b*, or towards *e* (*Fig.* 15), is about 1 inch and a quarter, and from thence it leſſens gradually to *f*, which is the point. It's breadth *a b* (*Fig.* 16) is the ſame as the thickneſs *c o* (*Fig.* 13) of the plank of the ſhare, and it leſſens gradually from thence to its point *c* (*Fig.* 16). A notch is made in the upper part of this point, between *e* and *b* (*Fig.* 15, or between *a* and *b* (*Fig.* 16), to receive the lower end of the angular ſide *o b c* (*Fig.* 13) of the plank.

The ſole *e a* (*Fig.* 15), or *a d* (*Fig.* 16), is of the ſame length and breadth as the bottom *c m*, or *o n* (*Fig.* 13) of the plank which it covers. It is about, but not more than, two thirds of an inch thick towards *e b* (*Fig.* 15), and half an inch thick at it's end *a c*.

Towards this end are the two thin iron ears, which lie cloſe to the two ſides of the plank, to which they are faſtened by a ſingle nail, which paſſes through the plank, as at *b*, *Fig.* 17.

This ſhare is alſo faſtened to the bottom of the plank by a flat-headed iron pin *g b*, *Fig.* 15, which goes through the ſhare at *n*, and enters into the middle of the thickneſs of the plank. The head *b* of this pin is flat, and lies even with the bottom of the ſole, in the manner indicated by the pricked lines at *a*, *Fig.* 17. Towards the flat end *c* of this pin is a hole, through which, and through the plank, a ſmaller pin or nail is driven, as is denoted by the pricked circle in the ſame figure.

The point of the ſhare, and the bottom of the ſole, which rubs upon the ground, ſhould be of ſteel. The different thickneſſes given to the ſole, ſhew that it's point inclines a little downward, by which means it enters into the earth very eaſily.

Fig. 18. repreſents a perſpective view of a thin plate of iron, which is to cover the plank of the ſhare, as in *Fig.* 20, to preſerve it from the friction of the ground, which would otherwiſe ſoon wear it out. The thickneſs of this plate, which ſhould be equal every where, is at moſt one twelfth of an inch. It is bent at *a b*, *Fig.* 18, in ſuch manner that this bending ſits cloſe to the ſharpened edge *c d*, *Fig.* 20, of the plank; the angle *b*, *Fig.* 18, being fitted to the notch *c* (*Fig.* 20) in the iron part of the ſhare, and the lower edges *b c*, *a d*, of this plate (*Fig.* 18) joining on both ſides to the upper edges of the ſole of the ſhare, as in *Fig.* 20. The breadth of this plate from *a* to *b* (*Fig.* 20) is about 4 inches, and each half of it's length, from *c* to *a*, or from *d* to *b*, is about 7 inches and a half. *Fig.* 19 is the plan, or bottom, of this plate.

As this plate covers the ears of the ſhare, and at the ſame time it's own angle *c* (*Fig.* 20) is covered by the point of the ſhare, theſe two pieces muſt be put on together. This plate is nailed to the two oppoſite ſides of the plank.

The two ends of this plate extend beyond the hindmoſt part of the plank of the ſhare, in the proportion of *b b*, *Fig.* 20: and in this ſpace, between theſe two ends, is the opening of the pipe through which the ſeed drops into the furrow, as was ſaid before.

The tenon *l g* (*Fig.* 12) of the ſhare now deſcribed, and there are three ſuch) enters into one of the three mortiſes *P*, *Q*, *R* (*Fig.* 2), through the bottom of which it is paſſed, and is fixed above by a wedge driven into the hole *k* (*Fig.* 12). Theſe ſhares are ſituated in ſuch manner that their point faces directly the fore-part of the drill. One of them is repreſented as fixed towards the end *b* of one of the beams, in *Fig.* 3, which exhibits the profile of that beam.

Of the piece which is placed under the middle of the table, and which bears the middle Share, Pl. II.

The piece *K L* (*Fig.* 2), which has been already ſpoken of*, is repreſented with it's bottom upward, and in perſpective, at *a b*, *Fig*, 21. with the ſhare *A* and it's tenon *B*, and with the table, which are alſo inverted in the ſame manner. *Fig.* 22 is a geometrical repreſentation of the under ſide of the ſame piece, and of part of the table, excepting the ſhare, which is omitted here, and of which only the bottom of the mortiſe is ſeen at *B*.

To the end *L* of this piece (*Fig.* 22) is faſtened the ring, or bridle before mentioned. This bridle is ſhaped nearly like a horſe-ſhoe; the breadth of each of it's branches is three fourths or five ſixths of an inch; it's total breadth is the ſame as that of the piece to which it is faſtened; it's total length is three inches and a half, and it's thickneſs every where is about one ſixth of an inch. The whole thickneſs of the two branches of this bridle is let into the piece of wood to which it is faſtened, ſo that it forms an even ſurface. This bridle is faſtened to the piece by two flat-headed ſcrews, which lie even with the branches of the bridle, through and into which they are ſcrewed. It is placed in ſuch manner that the outſide of its circular part *L* is one inch and a quarter diſtant from the edge *e f* of the table. It is uſed only when the drill is put upon its hind-carriage.

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* *p.* 37.

a and *b* are the heads of two large flat-headed ſcrews, which paſs through the piece *K L*, and fix it to the table. From the centre of the head *b*, to the edge *c d* of the table, is one inch and two thirds. From the centre of the head *a*, to the edge *e*, *f* of the table, is one inch and one third. Theſe two ſcrews are placed in the middle of the breadth of this piece *K L*. Their diameter is five twelfths of an inch, and that of their head is an inch and a twelfth. Theſe heads are flat, and ſcrew in to a level with the wood.

Of the two Bridles which receive the end of the Bar which ſupports the Drill upon it's hind-carriage. Pl. II.

Underneath this piece *K L* are likewiſe faſtened two bridles very like each other. They are repreſented in perſpective by the ſingle *Figure* 23: but both of them may be ſeen in their proper places, at *g h* and *e f*, *Fig.* 21. Their place in *Fig.* 22 is marked only by pricked lines, in order to let the pieces under them be ſeen. Theſe two bridles are made of a flat piece of iron one inch and a ſixth wide from *a* to *b*, or from *c* to *d* (*Fig.* 23), and a very little more than one ſixth of an inch thick. They are bent ſquare at *c d* and *g f*, and are pierced with two holes, *b* and *e*, one fourth of an inch in diameter, of which the centres are three fourths of an inch from the ends of the iron. Thus far theſe two bridles are like each other. What they differ in, is as follows. That which is placed at *g h* (*Fig.* 21), is 3 inches and one ſixth high, from it's bottom *a* to the upper ſurface of it's top *c*, or from *e* to *f*, *Fig.* 23; and this height in the belt which is placed at *e f* (*Fig.* 21), is 3 inches and five twelfths: that which is placed at *g h* is 2 inches and five ſixths long, from it's outſide at *c d* to it's outſide at *g f* (*Fig.* 23); and this part of the bridle placed at *e f*, is three inches and one third.

Both theſe bridles placed at *g h* and *e f* (*Fig.* 21), go over the piece of wood *a b*, to which their ends are faſtened by flat-headed ſcrews, which paſs through the holes *b* and *e* (*Fig.* 23) before mentioned. Theſe ends reſt immediately upon the table. As the diſtance between the ends of the bridle *e f* is exactly equal to the breadth of the piece to which they are faſtened, they are applied to the two lateral ſurfaces of that piece, without being let into it: but as the bridle *g h* is not quite ſo long, the ends of this are let into thoſe ſurfaces, as is ſeen in *fig.* 21, and in the pricked plan of theſe two bridles *h i*, *k n*, *Fig.* 22. The ends of theſe bridles ſtand perpendicular to the table. The bridle *g h*, *Fig.* 21, is 1 inch and fifteen twenty-fourths from the edge *t s* of the table; and the bridle *e f* is 5 inches and eleven twelfths diſtant from the ſame edge *t s*.

The uſe of theſe two bridles is to receive the end of the bar hereafter deſcribed (*Pl.* V, *Fig.* 83, 84)

84), which ſerves to ſupport the drill upon it's fore-carriage, when the hind-carriage is joined to it: and to prevent this end of the bar from ſlipping out of theſe bridles, a moveable iron pin is put through it: This pin is ſeen in *Fig.* 83, ſuſpended by a piece of pack-thread. It paſſes through the bridle *L* (*Fig* 2 & 22), & *b* (*Fig.* 21), before deſcribed.

Of the upper Surface of the Table. PL. II.

Fig. 24 repreſents a geometrical plan of the upper ſurface of the table, one end of which is omitted, as ſuperfluous in this figure, becauſe both its ends are alike. The pricked line *l b* is traced here only to mark the middle of the table, and determine ſome meaſures. The fore-ends of the beams appear here at *f* and *g*, with their mortiſes *A* and *B*, into which their ſhares are faſtened. *C*, *D*, *E*, *F*, are the four large flat-headed ſcrews which faſten the table to the beams. The diameter of theſe ſcrews towards their head is five twelfths of an inch, that of their head is 1 inch and a twelfth, and their length is 3 inches and ſeven twelfths. They enter into the middle of the breadth of the beams, and the centres of the holes in the tables through which they paſs, are eleven twelfths of an inch diſtant from the neareſt edges of the table. The whole breadth of the table, at *C D*, or *E F*, is eight inches and two thirds. The two corners *G* and *H* are thirteen inches diſtant from the middle line *l b*, and the end *K* is 1 foot 3 inches and three fourths diſtant from the ſame line *l b*. The thickneſs of this table is every where 1 inch and two thirds.

At each end of the table is a notch *K L P*, of which the inner ſurfaces are perpendicular to each other. Theſe notches are at *H* and *L* in *Fig.* 1. Each of them is three inches and three quarters long, from *K* to *L*, *Fig.* 24, and 1 inch ſeven twelfths wide from *L* to *P*. They are ſituated in the middle of the breadth of the table. Their uſe is to receive the lower end of two ſtandards hereafter deſcribed (*Fig.* 34), of which one is ſeen at *M H*, *Fig* 1, and the baſe of the other towards *L*.

This table has two holes, *M* and *N* (*Fig* 24.) of which the upper openings are exactly equal, and alike ſituated. Each of them forms a right-angled parallelogram *a b i n*. The ſide *b i* is parallel to the edge *D F* of the table, from which it is 1 inch and a half diſtant, and it's length is 3 inches and a quarter.

The upper edge of the end *a n* is eleven twelfths of an inch diſtant from the middle line *l b*, and it's length is 1 inch and eleven twelfths. The inner and parallel ſides *a b*, *n i*, of theſe holes are perpendicular to the upper ſurface of the table; but their ends *a n*, *b i*, are ſloped, in ſuch manner that each of them forms an angle of 50 or 55 degrees towards the line *l b*. This is expreſſed in the profile of theſe two holes (*Fig.* 25), by the angles *b a d*, *b c e*, and *g o f*, *g n b*, each of which has that meaſure.

Q, *R*, *S*, *T*, are four mortiſes, of equal ſize and depth, cut perpendicularly to the upper ſurface of the table. Each of them is nineteen twenty fourths of an inch long, in the ſame direction as the] length of the table, two thirds of an inch wide, and about 1 inch deep. They are intended to receive the 4 feet of the hopper, which will be deſcribed hereafter (*Fig.* 76, *Pl.* IV). Two of theſe feet are ſeen in their mortiſes at *k* and *l*, *Fig.* 1. The centre of each of theſe mortiſes is 6 inches and five twelfths diſtant from the line *l b* (*Fig.* 24), and 1 inch and three quarters from the edges *C E*, *D F*, of the table.

Of

Of the Bridles which receive the end of the Bar which ſupports the drill upon it's fore-carriage. Pl. II.

From *k* to *F*, *Fig.* 24, is a bridle, which is ſeen in front in *Fig.* 26. It is made of iron, 1 inch or 1 inch and a twelfth broad, and one ſixth of an inch thick. It is bent in a ſemi-circle at *a c b*, and lies flat upon the table at it's end *a* and *b*, which are faſtened to it by two flat-headed ſcrews *a* and *b*, *Fig.* 26, and *k m Fig.* 24. This bridle is perpendicular to the upper ſurface of the table. The higheſt part of the upper ſide of it's arch *c*, *Fig.* 26, is 2 inches above the table; and it's width, from outſide to outſide, from *e* to *i*, is 2 inches and a half. The length of each ſtrait part, or claw, which is faſtened to the table, is 1 inch and a quarter. The centres of the ſcrews *k* and *m (Fig.* 24*)*, are each 1 inch and three quarters from the middle line *l b*, and 4 inches from the edge *D F* of the table.

d r q (Fig. 26*)*, is the upright of another bridle, of which the top, or upper ſurface, is ſeen at *x d p q*, *Fig.* 24, the front and ſide in the perſpective *Figure* 27, and the back and ſides in the perſpective *Figure* 28. The hinder ſurface of the two claws, repreſented at *a* and *c (Fig.* 28*)*, is ſcrewed on to the fore-ſurface of the table, as at *f g* and *b k, Fig* 26, by two flat-headed ſcrews, each of which is 1 inch and ſeven twelfths long, and near a quarter of an inch in diameter towards it's head, which is half an inch in diameter. The middle of this bridle anſwers to the middle of the length of the table. The under ſurface of the bridle and of it's wings, anſwers to the plane of the fore ſurface of the table, to which it is faſtened. The length of each wing is about 2 inches and a half; their breadth is five ſixths, and their thickneſs a quarter of an inch. The length and thickneſs of it's arched part are equal to thoſe of the wings. The bending of that part is ſuch as is repreſented at *g d r q b*, *Fig*. 26. The diſtance *g b* between the two wings is 1 inch and eleven twelfths. The greateſt width of the bridle, from outſide to outſide, as at *d q*, is 2 inches and three fourths; and laſtly, the upper ſurface of it's higheſt part *r*, is 1 inch and two thirds above the upper ſurface of the table.

The uſe of theſe two bridles is to receive the end of the bar which will be deſcribed hereafter (*Fig*. 82. *Pl*. V,). This bar is ſeen at *x d*, *Fig*. 1, where one of the rings appears towards *d*. A wooden wedge *o t* (*Fig*. 24), is ſlipped, if there be occaſion for it, between this bar and the table, to which laſt it is faſtened by a ſingle flat-headed ſcrew *t*, around which it turns, as around a center. The ſhape and extent of this wedge is ſuch as is here repreſented according to the ſcale. It's thickneſs, throughout, is ſeven twelfths of an inch, excepting only at the part *r o e*, where it's upper ſurfaceinclinesfrom *r*, to *o e*, in ſuch manner that the edge *o e* is almoſt ſharp, that it may ſlide, like a wedge, under the end of the abovementioned bar, which paſſes through the two bridles or belts. The length of this piece is 5 inches and one twelfth, from the centre *t*, to it's end *o e*. This centre *t* is 6 inches and one ſixth from the edge *D F* of the table, and 4 inches and a quarter diſtant from the middle line *l b*. We ſhall hereafter ſee, that the bar which enters into the two belts now deſcribed, ought not to fill entirely the belt *a b c*, *Fig*. 26, but ſhould leave room to introduce under it the wedge juſt ſpoken of, which is not to be inſerted but when it is intended to make the other end of the bar preſs hard upon the axle-tree of the fore-carriage, which ſhoud never be done at

the

the time of ſowing, unleſs the huſbandman would ſcarcely bury the ſeed.

Of the two Pipes of the Shares of the Beams. Pl. II.

Through the two holes *M* and *N* of the table (*Fig.* 24), paſs two braſs pipes, which deſcend to, and open at, the back of the ſhares faſtened in the mortiſes *A* and *B* of the two beams. Theſe pipes are ſeen at *d* and *f* in *Fig.* 1, from whence they paſs through the two holes in the table and terminate behind the two ſhares *D* and *K*, as is repreſented in perſpective in *Fig.* 29. Theſe two pipes *f p a i k*, and *o r n l*, (*Fig.* 29,) are perfectly alike. They are almoſt ſquare during their whole length; wider towards the end *f d*, than towards the end *k*; and they are made of plates of braſs, ſomewhat leſs than a twelfth of an inch thick, well ſoldered togther. Their opening at *f d* forms a parallelogram, which is an inch and one ſixth wide from *b* to *f*, and an inch and three quarters long from *b* to *d*. The plane or perpendicular projection of theſe openings in the table, is indicated in *Fig.* 24, by the pricked lines between the letters *M* and *N*, where it is to be obſerved, that they are both equally diſtant from the middle line *l b*, and an inch and a half from the edge *D F* of the table. All the rims of theſe openings, *f*, *b*, *d*, *b*, *o*, (*Fig.* 29,) are nearly parallel to the upper ſurface of the table, above which they riſe two inches and two thirds: As theſe two pipes are alike, and ſituated in the ſame manner, one on the right, and the other on the left hand ſide of the drill, it will be ſufficient to apply to one of them, what remains to be ſaid of both. This pipe runs in a ſtrait, but oblique line, from it's opening *f d* to *i*, directly behind and unto the ſhare, from whence it's direction becomes perpendicular, to it's other opening *k*, which is at the height of 3 inches and a quarter from the bottom *g* of the ſhare. From it's bending at *i*, to the opening *k*, is 3 inches. This opening *k* is a ſquare, of which the ſides are two thirds or three quarters of an inch long.

This pipe is held to the ſide *p* of the hole, by a piece of iron which is under the table; and it is alſo faſtened near the bending *i*, by another piece of iron fixed under the beam. Theſe faſtenings are ſeen in *Fig*. 30, which repreſents, in perſpective, the bottom *C D* of the table, *E F* of the beam on the right-hand ſide of the drill, and the ſhare *G* which is faſtened to it. *q l* is the upper opening of the pipe, which runs from thence cloſe to the ſide *a b* of the hole in the table, where it is faſtened by a plate of iron, *n x*, about one eighth of an inch thick. In this plate is a notch which ſits cloſe to three ſides of this pipe. This plate is faſtened to the under ſurface of the table, by two flat-headed ſcrews *x* and *n*. The pipe continues in the ſame direction from it's upper opening *q l*, to it's bending at *e*, behind the ſhare; but from thence to *f*, it follows the direction of the back of this ſhare. It is faſtened towards this bending by an iron ſquare *k i h g*, the thickneſs of which is about one eighth of an inch. This ſquare is faſtened under the beam by two flat-headed ſcrews *k* and *i*, and to the pipe by two other ſcrews *g* and *h*, the ends of which ſcrew into a piece of iron which is ſoldered to the pipe, and which is ſeen between the ſquare and the pipe, from *f* to *e*. The beam *A B* has a ſhallow notch at *d*, to make room for the paſſage of the pipe.

Of the Pipe of the middle Share. PL. II.

The two pipes which terminate behind the two ſhares faſtened near the ends of the beams, at *Q* and *R* (*Fig.* 2), have now been deſcribed. A third pipe, of nearly the ſame form, terminates behind the third ſhare, which is faſtened at *P* in the piece *K L*. This is the pipe which paſſes between *U* and *y*, in *Fig.* 1, in order to it's terminating behind the ſhare *e C*.

This piece *K L* is repreſented in perſpective at *A B*, *Fig.* 31, which ſhews it's right ſide, with it's ſhare *C*, and the portion of the middle of the table where are the two holes *D E*, through which paſs the two pipes before mentioned.

This third pipe is made like the two others, of plates of braſs, of the ſame thickneſs and the ſame ſhape. It's opening *b l* forms a parallellogram of nearly the ſame ſize as the ſimilar openings of the two other pipes. The plane of this opening, or it's perpendicular projection, upon the table, is indicated by pricked lines near *o c e*, *Fig.* 24, where it is to be obſerved that the middle of this parallellogram is in the middle line *l b* of the table, and that its ſide *c e* is 5 inches and five twelfths diſtant from the edge *D F* of the table. The rims of this opening *b l* (*Fig.* 31), are raiſed about 2 inches above the upper ſurface of the table. From thence this pipe deſcends in a ſtrait, but oblique line, towards the ſhare which is behind the table; and at the ſame time bears to the right to *d* and *c*, where it bends, in order to take the direction of the lateral ſurface of the piece *A B*, againſt which it reſts. From thence, it continues in this direction to *r*, where it bends again, to *p*, immediately behind the ſhare; and there it is bent again, ſo as to deſcend perpendicularly behind this ſhare, down to *k*, which is within 3 inches and a quarter of the bottom of the ſhare *G*.

The table is notched at *H*, to let in one ſide of the pipe. This notch is alſo ſeen at *R*, in *Fig*. 24. The pipe is faſtened in this place by an iron plate *e f*, *Fig*. 31, about one eighth of an inch thick, which is fixed upon the table by two flat-headed ſcrews near *e* and *f*. This piece is repreſented by itſelf in *Fig*. 32. *m n*, *Fig*. 31, is a piece of iron, at leaſt one ſixth of an inch thick, faſtened by two ſcrews, at *N*, againſt the ſide of the piece of wood *A B*, into which the thickneſs of this iron is let, as may be ſeen at *m*, in ſuch manner that the outward ſurface of this piece *m n*, is level with that of the piece of wood *A B*. The pipe is faſtened againſt this piece of iron *m n*, by a belt fixed by two ſcrews to the piece of iron *m n*. This belt is repreſented by itſelf in *Fig*. 33.

Of the Standards. Pl. II, & III.

In the notches *Æ W* at the two ends of the table, *Fig*. 2, *Pl*. I. are placed two ſtandards, repreſented in perſpective in *Fig*. 34, *Pl*. II, with the two ends of the table, of which the middle is ſuppreſſed, as needleſs in this repreſentation. Theſe two ſtandards being exactly alike, it will be ſufficient to deſcribe one of them.

In each ſtandard may be diſtinguiſhed three parts, namely, the head, which reaches from the line *p a*, to the top of the moulding *b d s*; the baſe, which extends from the top *b d s* of the moulding, to the under part of the ſhoulder *f u q*; and the tail or tenon, which begins at the bottom of the ſhoulder.

All the ſides of this ſtandard are at right angles to each other, excepting only the two indentures *p* and *a* in the head, and the mouldings at the baſe. The inner ſurface *A B,* which faces the other ſtandard, is every where an even plane.

The head is 3 inches and a quarter wide, from *b* to *d*; 2 inches and one ſixth thick, from *d* to *s*; and 7 inches high, from the line *b d* to the line *p a*.

The baſe is 4 inches and five ſixths wide from *f* to *u*; 2 inches and five ſixths thick from *u* to *q*; and 2 inches and a half in perpendicular height, from *f u* to *b d*.

The tail or tenon which proceeds from the lower middle of the baſe, is equal in breadth *g h*, to the breadth *u q* of the baſe, that is to ſay, it is 2 inches and five ſixths wide. It's length, *t g*, is 6 inches and a quarter. It's thickneſs is the ſame as the width *P L* (*Fig.* 24,) of the notch in the end of the table, which receives this tenon; that is to ſay, one inch and ſeven twelfths. The hole or mortiſe *k n* is in the middle of the breadth of the tenon, and forms a right angled parallellogram, 2 inches long from *m* to *k*, and eleven twelfths of an inch wide from *n* to *m*. The height of this hole is determined by the thickneſs of the table, in ſuch manner that the diſtance between the bottom *f u q* of the baſe, to the top *n m* of the hole, is ſomewhat leſs than the thickneſs of the table.

Each ſtandard is faſtened to the table, as may be ſeen in the *Figure*, in the ſame manner as a common turning lathe is faſtened, by a key *D*, about 8 inches and a half long, driven tightly up to it's middle, in that part of the mortiſe which is under the table; and for greater ſolidity, one of the keys is put in at the fore part of one mortiſe, and the other at the hind part of t'other.

A round hole, 1 inch and five twelfths in diameter, is bored through the head of the ſtandard, near *A*. The centre or axis of this hole is exactly

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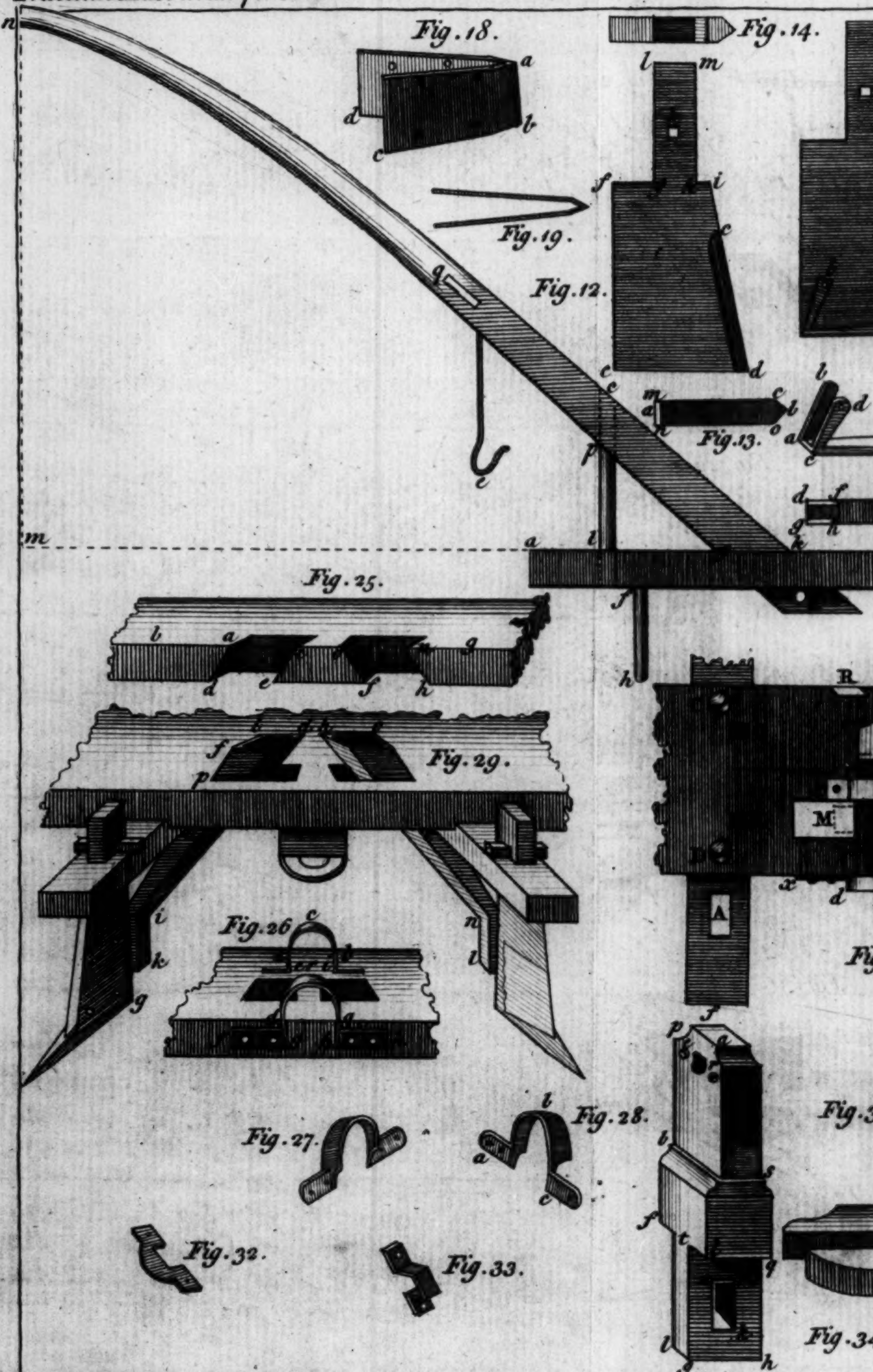

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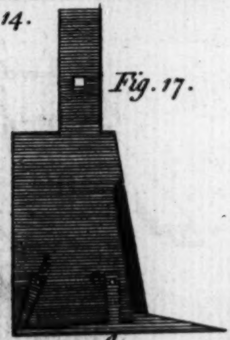

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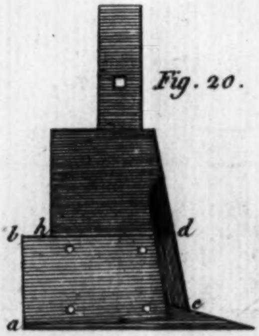

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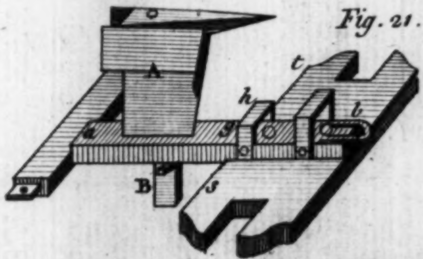

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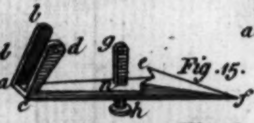

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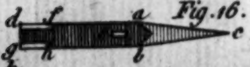

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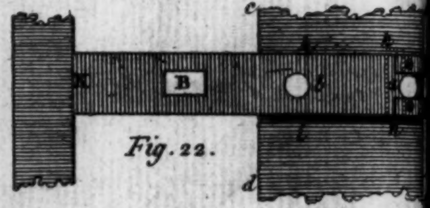

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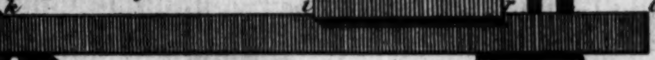
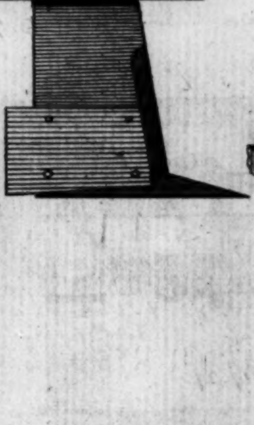


Fig. 3.



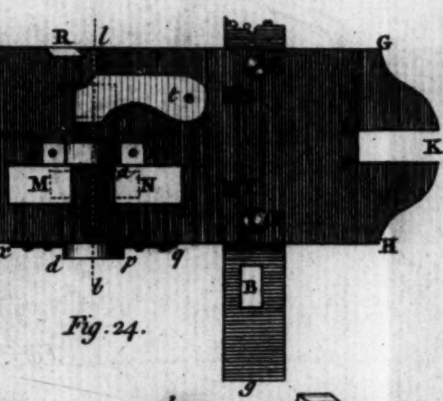


Fig. 24.

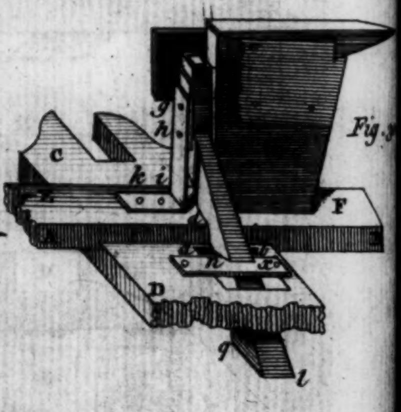


Fig. 30.

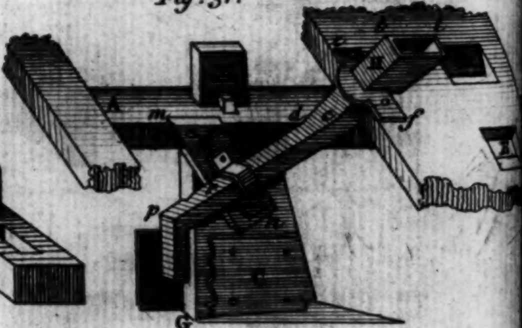


Fig. 31.

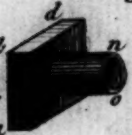
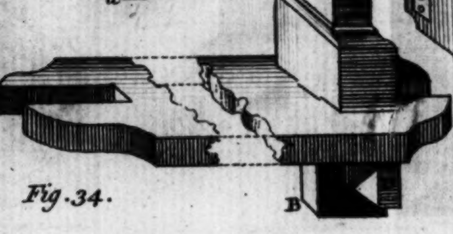


Fig. 35.



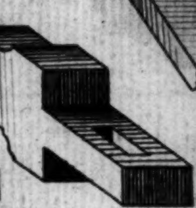


Fig. 34.

in the middle of the breadth of the head, and the hole is made through it exactly horizontal to the upper ſurface of the table, or, in other words, perpendicular to the ſide of the ſtandard. The pipe *n o* of the ferrule, *Fig.* 35, is put into this hole. The diameter of this pipe is the ſame as that of the hole. The pipe *n o*, is of one piece with its ſcutcheon *a b d*, which is one third of an inch thick: it's breadth *a b* is 1 inch and five ſixths, and it's length *b d* is 3 inches. All it's ſurfaces are at right angles, and parallel to each other. The axis of this pipe is in the middle of it's ſcutcheon, and perpendicular to it's ſurface. Both the ſcutcheon and the pipe (being but one piece) are bored through with the ſame hole, which is five ſixths of an inch in diameter; and in the upper ſurface of the inſide of this hole is a groove, which reaches from one end of the hole to the other. One end of it is ſeen at *n*, and it's uſe will ſoon be ſhewn. The end *n o* of this pipe is put into the hole *A* of the ſtandard, *Fig.* 34, at the inner ſide *A B* of this ſtandard, and the ſcutcheon *a b d* is let into this ſurface at *c i*, where it is faſtened by two ſcrews, of which the ends are ſeen at *c* and *i*, in this *figure*, and at *e* and *r* in the adjoining repreſentation of the outſide of the other ſtandard. The two ſmall holes in the ſcutcheon are female ſcrews, to receive the ends of the ſcrews before mentioned, which are one third of an inch in diameter, and their head is two thirds. The outer ſurface *c i* of the ſcutcheon is made to lie exactly even with the inner ſurface of the ſtandard, and the centre of it's pipe is at the perpendicular height of 5 inches and ſeven twelfths above the upper ſurface of the table. Theſe two pipes (one in each ſtandard) are deſtined to receive the two pivots *a b*, *g b*, *Fig.* 36, *Pl.* III, of an iron axis; and the groove *n*, *Fig.* 35, *Pl.* II, then becomes uſeful, by affording the means of introducing a little oil, to keep the pivots from loſing their temper by their friction, and to make them turn with the greater eaſe.

The ſcutcheon and it's pipe ſhould be caſt in one piece, of good metal, ſufficiently hard, but by no means brittle.

Of the Axis and the pieces which are faſtened to it. Pl. III.

The pivots are of the ſame diameter as their holes; and their ſhoulders *b* and *b*, *Fig.* 36, are at the ſame diſtance from each other as the inner ſurfaces of the ſtandards, that is to ſay, 2 feet.

The axis is repreſented naked in *Fig.* 36; but the ſeveral pieces repreſented ſeparately in *Figures* 37, 38, 40, 41, 42, 43, 44, 45, and 46, are to be faſtened to it.

Fig. 39, repreſents all theſe pieces fixed upon the axis. It is to be obſerved here, that the long pivot *c* (*Fig.* 39), goes through the hole of the ſtandard which is on the left hand ſide of the drill, and the pivot *r* through the ſtandard on the right hand; ſo that all theſe figures exhibit a front view of the axis and it's pieces.

The pivot *a b* (*Fig.* 36), on the right hand ſide, is 1 inch and a quarter long; and that on the left, *b g*, about 2 inches. The diameter of the axis towards the ſhoulder *b* and *b* is 1 inch and a twenty-fourth part of an inch. From thence it thickens gradually to near the middle of it's length, in order to facilitate the fixing of the pieces which are to be ſlipped on, over it's two ends. In the middle, it's diameter is 1 inch and an eighth.

The firſt piece which is ſlipped over it's end *g* (*Fig.* 36), is repreſented in perſpective in *Fig.* 37: a ſection of it is ſeen in *Fig.* 38, and it appears in profile at *g a b q* in *Fig.* 39. It is a hollow cylinder, of which the outer diameter *a b*, *Fig.* 37, is one inch and thirteen twenty-fourths of an inch. It has a ſhoulder, of which the total diameter *c d*, *Fig.* 38, or *g q*, *Fig.* 39, is 3 inches and five twelfths. It's thickneſs from *a* to *b*, *Fig.* 38, is ſeventeen twenty-fourtns of an inch; the diſtance from *a* to *i* is five twenty-fourths of an inch; and the thickneſs *n m* of the ſhoulder is one ſixth of an inch. This hollow cylinder and it's ſhoulder are made of the ſame piece of braſs, caſt in a mould and afterwards turned, The diameter of the hollow of this cylinder is the ſame as that of the middle of the axis, upon which it goes very tightly, and is faſtened, as in *Fig.* 39, by a riveted pin *n*, one ſixth of an inch in diameter, which paſſes through the axis and the cylinder. This cylinder is placed in ſuch manner that it's rim *a b* is 8 inches and fifteen twenty fourths of an inch diſtant from the ſhoulder *c* of the axis *Fig.* 39, or from the ſhoulder *b Fig.* 36.

After this cylinder is firmly fixed, another hollow cylinder, repreſented in perſpective in *Fig.* 40, is forced over the end *g* of the axis *Fig.* 36, It's end *g* is put on firſt, and forced forward, till the edge of it's other opening *a b*, *Fig.* 40, is about a twelfth part of an inch beyond the ſhoulder *b* of the axis *Fig.* 36. The reaſon for putting it thus a little beyond the ſhoulder *b*, is, that it may not touch the pipe of the ſtandard when it turns.

This cylinder (*Fig.* 40) has, nearly in the middle of it's length, a ſhoulder, of which the flat ſide *f d*, which is alſo repreſented in full view in *Fig.* 41, forms a circle perpendicular to the axis of the cylinder. This circle or ſhoulder is 4 inches in diameter, and a quarter of an inch thick towards it's edge; but it is thicker towards the middle, as is ſeen in it's profile at *d Fig.* 39. The whole length of the cylinder between it's two ends *a b* and *g* (*Fig.* 40), is 3 inches; and the diameter of it's thickneſs at each end, *a b* and *c*, is 1 inch and five twelfths: the length *n a*, from the end *a b* to the flat ſide *d f* of the ſhoulder, is 1 inch and nine twenty-fourths.

This cylinder and it's ſhoulder are of one piece of braſs, caſt in a mould, and turned in a turner's lathe. When put upon the axis, over which it goes very tight, in ſuch manner that, as was ſaid before, it's end *a b* (*Fig.* 40), is placed about a twelfth part of an inch within the ſhoulder *b* of the axis *Fig.* 36, it is faſtened by a pin which goes in at the hole *c* (*Fig.* 40), and paſſes through the axis. This pin, which is of iron, and one ſixth of an inch in diameter, goes tight through the cylinder and the axis, without projecting at either of it's ends. This cylinder is repreſented as pinned at *N*, *Fig.* 39.

Fig. 42, is a wooden pully, of which a part is ſeen at *P Fig.* 1, and of which the hole in it's centre is of the ſame diameter as the end *a b* of the cylinder *Fig.* 40. This end of that cylinder is put through this pully, which is every where 1 inch and a quarter thick, that is to ſay, ſomewhat leſs than the length of the end *n a* of the cylinder *Fig.* 40; ſo that when the pully is put upon the cylinder, and it's ſide is placed againſt the ſhoulder *d f*, the end *a b* of the cylinder projects a little beyond the other ſide of the pully, to prevent it's rubbing againſt the adjoining ſtandard. This pully is repreſented in profile at *l m*, *Fig.* 39. It's extreme diameter, *f k*, is 8 inches; and it's groove *l m*, which is ſquare, is an inch and a quarter deep, and three quarters of an inch wide. This pully is placed cloſe to the braſs ſcutcheon, to which it is faſtened by three ſcrews, *A*, *B*, *C*, *Fig.* 42, which ſcrew into the three holes *a*, *b*, *c*, (theſe being female ſcrews) in the flat part of the ſhoulder *Fig.* 41, of the cylinder *Fig.* 40. Each of theſe ſcrews (*Fig.* 42,) is from a quarter to a third part of an inch in diameter; and their head, which is flat, is about a quarter of an inch thick and two thirds of an inch in diameter. Theſe heads are ſcrewed into the holes *a b* and *c*, till they lie even with the ſurface of the pully on that ſide.

To the other end *b* of the axis, *Fig.* 36, is fitted exactly, though ſo as to ſlip on with eaſe, a third hollow cylinder, *Fig.* 43, of which the profile is ſeen at *b*, *Fig.* 39. It is like that which is marked *N d* at the other end of the axis; with this only difference, that the extreme diameter of the end *b e* of the cylinder *Fig.* 43, is about two inches. This cylinder is faſtened to the axis by a thumb-ſcrew *e*, which goes through a female ſcrew in the cylinder, and of which the end enters into the hole *l* in the axis *Fig.* 36, which is not a female ſcrew: and that the end of the ſcrew may be directed to this hole, without any difficulty, when the cylinder is upon the axis, this laſt is provided with a ſmall tongue *k*, which goes exactly into the notch *f*, *Fig.* 43, as is ſeen at *e*, *Fig.* 39.

A pully exactly like the former is faſtened to the ſhoulder of this cylinder, by three ſimilar ſcrews, and in the ſame manner: obſerving equally here, that the outer ſurface of this pully do not rub againſt it's adjoining ſtandard. This pully is ſeen at *Q*, *Fig.* 1.

It is ſometimes neceſſary to take this pully and the cylinder off from the end *r* of the axis *Fig.* 39, which is the reaſon why this cylinder is faſtened by a ſcrew, and not by a pin, like the other. They are taken off, to make room for putting upon the axis the *cellular* cylinder, which is of caſt braſs, and turned in a lathe.

Of the cellular Cylinder.

This cylinder is ſeen in profile, upon the axis, at *p*, *y*, *g*, *q*, *t*, *z*, *Fig*. 39, and in perſpective in *Fig*. 44. *Fig*. 45 repreſents it's longitudinal ſection. The part of this cylinder which is between the two lines *y t* and *p z*, *Fig*. 39, is exactly like the above deſcribed cylinder *Fig*. 37 and 38, and *g*, *a*, *b*, *q*, *Fig*. 39.

The only difference between them, is that the one is fixed permanently to the axis, by a pin *n*, *Fig*. 39; and the other is faſtened by a ſcrew *v*, which paſſes through a female ſcrew near the end of the cylinder, which is ſtrengthened there for that purpoſe, by a moulding or collar *p z*. The end of this ſcrew enters into a hole *m* in the axis *Fig*. 36; but this hole is not a ſcrew. The other part of the cellular cylinder included between the two lines *y t* and *g q*, *Fig*. 39, is 3 inches and five twelfths long; it's outward diameter, throughout this length, is 2 inches and twenty-one twenty fourths of an inch: and it's inner diameter is 2 inches and a third. This inner diameter is a little wider towards the end *b c* of the cylinder, *Fig*. 44 and 45. It is exactly the ſame as the outer diameter of the projecting part *c d* of *Fig*. 37, which is to go into, and fit cloſely to, the end *b c* of the cellular cylinder, *Fig* 44; ſo that the the edge of this end *b c* may run quite up to the flat ſide of the ſhoulder of *Fig*. 37. The pricked lines in *Fig*, 45 and 38 are intended to expreſs the correſpondence of the parts of theſe two cytinders, which are to be united, by putting the end of one into the end of the other. *Fig*. 39 ſhews the cellular cylinder joined to the ſhoulder of the other cylinder: in which poſition it is that the cellular cylinder is faſtened to the axis by the ſcrew *v*, as before ſaid: and that the end of this ſcrew may be directed ſtrait to the hole in the axis, whenever this cylinder is put on, two contiguous lines or marks may be made, one upon the edge *p z* of the cylinder, and the other upon the axis.

Of the Cavities of the cellular Cylinder. Pl. III.

On the ſurface of this cylinder, between the the lines *y t*, and *g q*, *Fig*. 39, are ſcooped hollows or cavities, repreſented at large in *Fig*. 47, and ſeen in profile in *Fig*. 47, N°. 2. They are ſhaped nearly like a niche, which terminates in a cone at it's top, and is rounded gradually deeper and deeper down to it's bottom, which is a flat, perpendicular to the loweſt part of the cavity.

To conceive and fix the poſition of theſe cavities upon the cylinder, the two pricked lines *i x*, *o s*, muſt be drawn round the cylinder, at equal diſtances from the lines *y t* and *g q*, and diſtant from each other two inches and one third, which is the inner breadth of the ſeed box in which the cylinder is placed, as will be more particularly explained in the deſcription of it.

The breadth between the lines *i x* and *o s* muſt then be divided into ſix equal ſpaces, by five other parallel lines drawn round the cylinder. Each of theſe ſpaces marks the width of each row of cavities; and the ſix rows of cavities muſt face exactly the ſix valves of the bin, which will ſoon be ſpoken of.

After this, the places muſt be marked for twelve ſimilar cavities, placed at equal diſtances from each other, in each of the breadths traced round the cylinder; obſerving, that the length of the cavities is to be in the ſame direction as thoſe breadths; and alſo, that the flat end of each cavity muſt be undermoſt, and the rounded end uppermoſt, when the cylinder fronts the fore part of the drill, which is the view repreſented in *Fig.* 39; for it is the flat end of the cavities that is to go foremoſt, when the cylinder turns and drops the ſeed.

It is likewiſe to be obſerved, that each cavity ſhould be oppoſite to the interval between two cavities in the next adjoining rows, as they are placed in *Fig.* 39, 44, and 47.

It will be right to have two or three, or even more, cellular cylinders, equally fitted to the axis *Fig.* 39, but with cavities of different ſizes, in order to be thereby enabled either to ſow more or leſs ſeed, or ſmaller or larger ſeeds, ſuch as barley, lentils, peas, beans, millet, oats, &c. for each of which it's proper cylinder ſhould be uſed.

The cavities in *Fig.* 47, N°. 1 and 2, are of a ſize fit for wheat, barley, lentils: for millet, they muſt be much ſmaller; for peas, ſomewhat deeper; for oats, there ſhould be but eight or nine cavities in each row, in order that thoſe cavities may be made longer than for wheat, on account of the length of the oat, which is the only ſeed that I have found leſs eaſy to ſow than wheat: the reaſons are, the lightneſs of oats, their not ſlipping eaſily between each other, and their having at one end of the grain a pretty long, flexible, and elaſtic point. Theſe obſtacles ſometimes hinder the grains from entering into the cavities, and the ſeedſman muſt be more careful when he ſows oats, than when he ſows any other kind of grain; though, notwithſtanding theſe difficulties, I have had them ſown pretty well.

To ſow beans, the cylinder muſt have but three rows of cavities, of a length, breadth, and depth proportioned to the ſize of the beans. The bin,

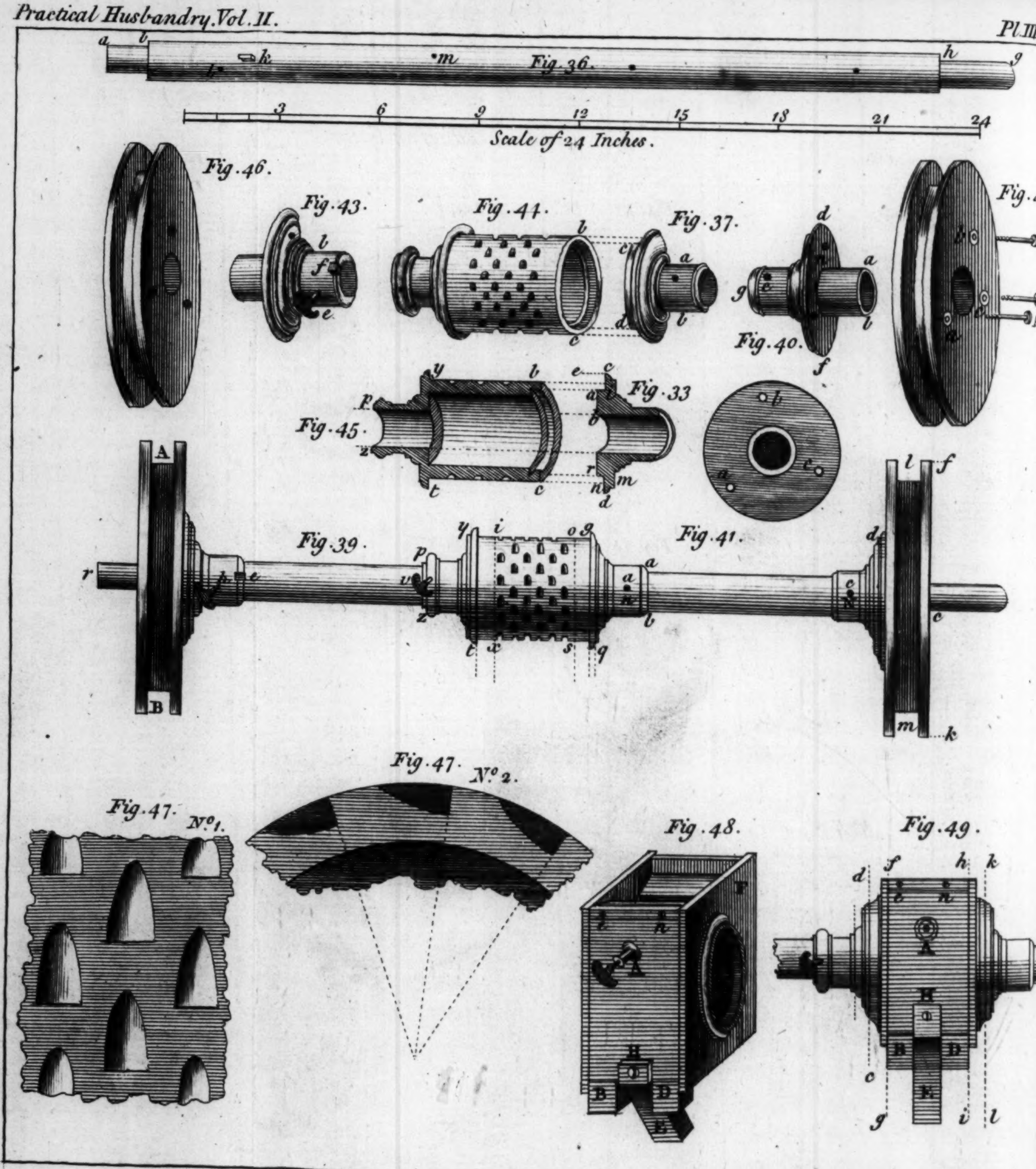


Fig. 36.
a
b
k
m
h
g
3
6
9
12
15
18
21
24
Scale of 24 Inches.
Fig. 46.
Fig. 43.
Fig. 44.
Fig. 37.
Fig. 40.
Fig. 33
Fig. 45.
Fig. 39.
Fig. 41.
Fig. 47. N.º 1.
Fig. 47. N.º 2.
Fig. 48.
Fig. 49.
A
B
C
D
E
F
H
l
f
m
k
r
p
v
z
y
i
o
g
t
x
s
q

which has ſix valves for wheat, ſhould have but three for beans, and theſe valves ſhould be proportioned to the breadth of the cavities, which muſt be placed exactly oppoſite to them, as for wheat.

The following rule will determine the proper ſize of the cavities, by applying, as may eaſily be done, what is here ſaid of wheat, to any other kind of grain.

The cavities muſt be large enough to contain three or four grains of wheat, and their depth muſt be ſuch that theſe grains do not riſe above the ſurface of the cylinder, in order that when the cavities filled with ſeeds, paſs under the valves of the bin, the grains may not fall out of the cavities. This will be ſtill better underſtood, after reading the deſcription of the ſeed-box.

Of the Seed-Box. Pl. III and IV.

After un-ſcrewing and taking off from the axis, the pully *A B*, *Fig*. 39, it's cylinder *b*, and the cellular cylinder *p z*, *g q*; the ſeed-box, *Fig*. 48, is placed upon the axis, by running the bared end of this laſt through a round hole in each of the two parallel ſides of the ſeed-box. The diameter of theſe holes is the ſame as that of the cellular cylinder, which is then to be put over the axis, by paſſing it's proper end through the hole in the ſide of the ſeed-box, which it traverſes, and faſtening it in the manner before directed. The pully is alſo then to be replaced. The front of this box is ſeen at *B*, *Fig*. 1.

Fig. 49 repreſents the box and the cellular cylinder placed upon the axis, where it is to be obſerved that the outer breadth of the box, expreſſed by the interval between the lines *d c* and *k l*, is exactly the ſame as the length of the cylinder expreſſed in *Fig.* 39, by the diſtance between the lines or ſhoulders *y t* and *g q*; ſo that the box is held between theſe two ſhoulders *y t* and *g q*. It is alſo to be obſerved, that the inner breadth of the box, expreſſed by the interval between the lines *f g* and *h i* in *Fig.* 49, is exactly the ſame as the length of the cylinder expreſſed by the lines *i x* and *o s* in *Fig.* 39.

This braſs box has neither cover nor bottom, but is formed of four plates, each five twenty-fourths of an inch thick. *Fig.* 50 repreſents the inſide of the plate *F G*, *Fig.* 48, which is on the left hand ſide of the drill, with the pieces which the box contains, and a ſection of the cylinder, lengthways of one of the rows of cavities. *Fig.* 51 repreſents the outſide of the plate oppoſite to the former, and which conſequently is on the right hand ſide of the drill.

Theſe two plates (*Fig.* 50 and 51) are exactly equal. Each of them forms a parallelogram, of which the length *A B* (*Fig.* 50 and 51) is four inches and eleven twelfths, and the breadth *B E* four inches and fifteen twenty-fourths. Both of them are perforated by a large round hole, of the ſame diameter as that part of the cylinder in which are the cavities. The centre of this hole is in the middle of the breadth of theſe plates, and the upper extremity *b*, of this hole (*Fig.* 50 and 51), is an inch and one ſixth diſtant from the upper edge, *D A*, of the plate. Both the plates have four mortiſes, *G*, *H*, *K*, *L*, *Fig.* 51, the breadth of which is equal to the thickneſs of the plates, and the length about half an inch; though this laſt is almoſt arbitrary. Both of them have alſo, directly facing each other, a hole at *n* (*Fig.* 50 and 51), three twenty-fourths of an inch in diameter, and of which the centre is at the diſtance of five twenty-fourths of an inch from the line *D A*, and half an inch from the line *A B*. The inner ſurface of both the plates is even; and laſtly, each of them has, on it's outer ſurface, a ſhoulder which projects round the rim of the great hole. One of theſe ſhoulders is ſeen in perſpective in *Fig*. 48. The profile of one of them is ſeen between the lines *d e* and *f g* (*Fig*. 49), and that of the other between the lines *h i* and *k l*. *Fig*. 54 repreſents a ſection of them both. The thickneſs of this ſhoulder, that is to ſay, the diſtance to which it is to project, has already been determined by the total diſtance between the lines *y t* and *g q*, *Fig*. 39. When the inner ſurfaces of theſe two plates (*Fig*. 50 and 51,) are laid againſt each other, their edges and holes, now deſcribed, ſhould coincide exactly.

What they differ in is, firſt, that one of them (*Fig*. 51) has a ſmall opening *M N*, which the other has not, and which will be deſcribed in it's proper place; and ſecondly, that the hole *n* (*Fig*. 50 and 51), is a female ſcrew in *Fig*. 50, to receive the end of a ſcrew which traverſes the box, but is not wormed in that manner in *Fig*. 51, where the outſide of the plate is hollowed a little around this hole, to make room for the flat head of this ſcrew, which will be ſpoken of hereafter.

The two plates now deſcribed are fixed in their proper places by means of two others (*Fig*. 55 and 56), which laſt are of equal ſize with each other. *D E*, *Fig*. 50, is the profile of *Fig*. 55, which is the back of the box; and *A B*, *Fig*. 50, is the profile of *Fig*. 56, which is the front of the box repreſented at *A*, *Fig*. 48 and 49.

The two tenons *A* and *B*, *Fig*. 55, enter into the two mortiſes which are hid near *G* and *H* in *Fig*. 50. The two other tenons *C* and *D*, *Fig*. 55, are expreſſed near *G H* in *Fig*. 50; and receive the mortiſes *G* and *H* of *Fig.* 51. In like manner the two tenons *E* and *F* of *Fig.* 56, enter into the mortiſes hidden near *K* and *L* in *Fig.* 50, where are marked the two other tenons, likewiſe ſeen at *G* and *H* in *Fig.* 56, which are to receive the mortiſes *K* and *L* of *Fig.* 51. The diſtance between the tenons of the ſame ſide of a plate, and conſequently between their mortiſes, is arbitrary; as is alſo the length of the tenons, which are pierced, in order to their being fixed very tightly by pins about the twelfth part of an inch thick. Theſe two plates (*Fig.* 55 and 56), when rightly placed between the two other plates, ſhould be perpendicular to them, and parallel to each other, as well as to the lateral edges of thoſe other plates, and the diſtance between them, from inſide to inſide, ſhould be four inches. The upper edges of the four plates, when they are put together, ſhould be horizontally level; by which means the bottom of the two largeſt plates will reach lower down than the ſmaller. Theſe two ſmaller plates, *Fig.* 55 and 56, are ſhaped like a parallelogram two inches and a third wide, and four inches and thirteen twenty-fourths long. This breadth anſwers exactly to the ſpace between the lines *i x* and *o s*, *Fig.* 39, and between the lines *f g* and *h i*, *Fig.* 49.

The plate *Fig.* 55, which is ſeen in perſpective in *Fig.* 52, has, quite a-croſs it's inner ſurface, a ſolid plint *x L*, which is of the ſame piece as the plate, and runs parallel to *f g*, *Fig.* 52 and 55. The bottom of this plint is flat, and it's top is arched like a portion of a circle. It's thickneſs from *i* to *n* is nine twenty-fourths of an inch, and it's projecture *i x*, *Fig.* 52, is ſuch that it's edge *x L* meets the ſurface of the cellular cylinder, as in the profile *d Fig.* 50.

The uſe of this plint is to ſtrengthen the aſſemblage of the plates; for which purpoſe it's ends *x L*, *Fig.* 52, ſhould join exactly to the larger plates: and it ſerves likewiſe to prevent the grains of corn from ſlipping down between the plate and the cellular cylinder.

To the top of the inſide of this plate is faſtened, by two ſcrews *a* and *p*, *Fig.* 52, a plate of braſs one twelfth of an inch thick. It's extent, *a*, *p*, *d*, *b*, is a rectangle parallelogram, of which the breadth *a p*, or *d b*, is the ſame as that of the plate to which it is faſtened; ſo that it's edges *a b* and *p d* lie cloſe to the inſides of the two largeſt plates, *Fig.* 50 and 51. The profile of this plate is ſeen at *a l b*. *Fig.* 50, where it is inclined from *l* to *b*, in ſuch manner that the whole length of it's edge *b d*, *Fig.* 52, is almoſt cloſe to the ſurface of the cylinder, directly above it's axis, as in the profile *b*, *Fig.* 50. But this plate muſt not quite touch the cylinder, becauſe it would then obſtruct it's motion, or at leaſt occaſion a needleſs and detrimental friction. It's uſe is to hinder the corn which fills the ſpace *F*, from falling down into the ſpace *M*, and to make it paſs only under the piece *r q* (which will ſoon be deſcribed), to drop from thence into three pipes, which begin near *e*, as will be ſeen hereafter.

The plate *Fig.* 56 (ſeen in perſpective in *Fig.* 53, with ſome pieces fixed to it), has, riſing upon it's inner ſurface, four, exactly ſimilar ſmall partitions, which are of a piece with the plate. Theſe four partions, *c p*, *d e*, *f g*, *h i*, *Fig.* 56, are ſeen in perſpective at *m s*, *o t*, *q v*, and *r x*, in *Fig.* 53. The top *r x* of all theſe partitions is rounded like the quarter part of a circle, and the bottom *x v* is flat, and at the ſame height as the axis of the cylinder, as may be ſeen in the profile *e* of one of theſe partitions (*Fig.* 50). The two outer partitions, *c p* and *h i*, *Fig*. 56, are at the edges of the plate, and the two others, *d e*, *f g*, divide the ſpace between *c* and *h* into three equal parts. Theſe partitions are about a twelfth part of an inch in thickneſs, and their rounded part terminates in an edge, that the grains which may chance to fall upon it may not lodge there. The height *u r*, *Fig*. 53, or *i h*, *Fig*. 56, of all theſe partitions, is nine twenty-fourths of an inch. The lower ends *s w*, *t æ*, *v a*, *x u*, *Fig*. 53, of all theſe partitions, are in a plane perpendicular to the plate, and parallel to the edges *b a*, *q r*, of this plate (*Fig*. 56).

This plate has alſo upon it's outer ſurface a ſmall cylinder, which is ſeen in profile at *K Fig*. 50, in front at *A*, *Fig*. 49, and in perſpective at *A*, *Fig*. 49, and *B*, *Fig*. 1. It's whole length is two thirds of an inch, and it's diameter is half an inch, excepting it's ſhoulder at the plate, which is a little more. This cylinder is pierced lengthways with a female ſcrew, which goes through the plate perpendicularly to it's ſurface, and through which paſſes a ſcrew *C q*, *Fig*. 50, five twenty-fourths of an inch in diameter, of which the end is ſeen at *q*, and the head at *C*. This head is alſo ſeen at *B Fig*. 1. The hole is ſeen at *k* (*Fig*. 56, in the inner ſurface of the plate. The centre of this hole *k* is in the middle of the breadth of the plate, and at the diſtance of five twenty-fourths of an inch from it's edge *a b*. This fixes the place of the ſcrew and of it's cylinder; the only uſe of which laſt is, by it's length, to give the greater ſtability and firmneſs to the ſcrew, which keeps the bin at a greater or leſs diſtance from the cellular cylinder.

Of the Bin and it's Valves. Pl. IV.

The Bin, which has ſix valves, is ſeen in profile at *q n*, *Fig*. 50. The outſide of this bin is ſeen in perſpective at *g h n*, *Fig*. 53, with the ends of the valves *a*, *b*, *c*, *d*, *e*, *f*, ſeparated from each other by partitions. It is ſuſpended in the box by the axis or ſcrew before-mentioned (*Fig*. 50 and 51), which goes in at the hole *n* in the end *Fig*. 51 of the box, then paſſes through the hole *n* of the bin, *Fig*. 50 and 53, runs quite through the length of the bin, and ſcrews into the female ſcrew in the plate *Fig*. 50, which, as was ſaid before, is directly oppoſite to the hole *n* in the plate *Fig*. 51. The head of this ſcrew, at *n*, *Fig*. 51, lies even with the outer ſurface of this plate.

Fig. 57 repreſents in perſpective the bin alone and it's partitions, all made of one piece, or plate of braſs. *Fig*. 58 repreſents geometrically the fore-part of the bin, which is here turned towards the ſeedſman. *Fig*. 60 repreſents it's back; *Fig*. 62, it's bottom; *Fig*. 59, one of it's outmoſt ſides, or largeſt partitions, both of which are equal and alike; and *Fig*. 61, the ſide or profile of one of the ſmaller partitions, which are all equal and like to each other.

The whole length of the bin from outſide to outſide, that is to ſay, from *a* to *c*, and from *b* to *d*, *Fig*. 58, or from *c* to *d*, and from *e* to *f*, *Fig*. 60, is the ſame as the breadth of the inſide of the box, or of the ſpace between the lines *i x* and *o s*, *Fig*. 39, or *f g* and *h i*, *Fig*. 49. The bottom of the bin is a parallelogram *i*, *k*, *d*, *b*, *Fig*. 58, or *a*, *b*, *d*, *c*, *Fig*. 60, eleven twenty-fourths of an inch wide at *a c* and *b d*. This bottom is of the ſame thickneſs as the largeſt partitions or ſides *a b*, *c d*, *Fig*. 58, and the five ſmaller partitions; that is to ſay, three twenty-fourths of an inch. Theſe partitions, both great and ſmall, are at equal diſtances from each other, and all their ſides are perpendicular to the bottom of the bin.

The whole length of the two largeſt partitions, *Fig.* 59, from *b*, to the pricked line *g d*, which is perpendicular to *a b*, is one inch and ſeventeen twenty-fourths. Their breadth at *a i* and *b c* is five ninths of an inch. The line *c m*, parallel to *b a*, is eleven twenty-fourths of an inch long. The notch *l m* is one twelfth of an inch deep. The angle *a b*, *c*, is of eighty-five degrees. The perpendicular diſtance from the centre of the hole *s*, to the line *g d*, is a quarter of an inch; and the perpendicular diſtance from the ſame centre to the line *a b*, is five twelfths of an inch. The diameter of this hole is a full twelfth of an inch. The perpendicular diſtance from the centre of the hole *r*, to the line *g d*, is very near, but not quite, one ſixth part of an inch; and the perpendicular diſtance from this ſame centre to the line *a b*, is five twenty-fourths of an inch. The diameter of this hole is one ſixth of an inch. Theſe two main partitions, *a b* and *c d*, *Fig*, 58, which have now been deſcribed in the account of *Fig*. 59, are exactly alike, and pierced in the ſame manner; ſo that if they could be laid flat together, inſide to inſide, their dimenſions and holes would tally perfectly.

It is through the hole *r*, *Fig*. 59, that the ſcrew or axis is paſſed which keeps the bin ſuſpended to the plates, and which was mentioned before. Theſe two holes *r r* are ſeen in *Fig*. 57, where their axis is indicated by two pricked lines. And it is through the hole *s*, *Fig*. 59, that the ſcrew or axis is paſſed which goes through the valves, next to be ſpoken of, and by which they are ſuſpended in the bin. Theſe two holes *s s* are ſeen in *Fig*. 57, with their axis, which is indicated by two pricked lines.

Fig. 61 repreſents the profile of the ſmall partitions. It's total height from *a b* to *c d*, is equal to the breadth *d b* of the bottom *Fig*. 60, as is ſhewn in *Fig*. 58. The ſhape and ſize of theſe ſmall partitions is exactly like,and equal to that part of *Fig*. 59, which is included between the lines *e*, *f*, *b*, *c*; ſo that their edges would tally in all reſpects, if they were laid one upon the other. The line *c d*, *Fig*. 61, is perpendicular to *c a*.

The edge *m c*, *Fig*. 59, is a bevil, ſloped towards the inſide of the bin, as at *e f*, *Fig*. 57, and *a d*, *Fig*. 62. The like edge *z b*, *Fig*. 57, and *h f*, *Fig*. 62, is ſloped in the ſame manner. All the ſimilar edges *e b*, *Fig*. 61, of the ſmall partitions, which are included between the lines *e f* and *b d*, *Fig*. 58, are bevils on each ſide, and form as many acute edges, as is ſeen in *Fig*. 62, between the lines *a b* and *d f*. The diſtance between the lines *a b* and *g b* is five ninths of an inch.

Fig. 58 is repeated in *Fig*. 64, with only the addition of the ſix ſprings, *a b*, *c d*, *e f*, *g h*, *i k*, *l m*, each of which is faſtened by a ſmall ſcrew, *a*, *c*, *e*, *g*, *i*, *l*, at one of their ends, next to the bottom of the bin, and in the middle of the interval between two partitions. The breadth of theſe ſprings is nearly equal to two thirds of this interval, and their thickneſs is the ſame as that of a common ſpring of a watch, which is the ſtuff they are made of. *Fig*. 63 exhibits a front view of one of theſe ſprings. Their length and bending, when in a ſtate of reſt, is repreſented in the profile *e d*, *Fig*. 65. *b a*, *Fig*. 66, ſhews the profile of theſe ſprings in a ſtate of contraction.

Fig. 64 is repreſented in *Fig*. 67, with only the addition of the ſix valves *c d*, *e f*, *g h*, *i k*, *l m*, *n o*, ſeen in profile in *Fig*. 65 and 66. Each of theſe ſix valves is, at moſt, one twelfth of an inch thick, and their total length, *a b*, *Fig.* 65, is one inch and thirteen twenty-fourths. The ſix valves, put together, weigh twenty penny-weights, or five ſixths of an ounce. When put in their proper places (*Fig.* 67), each of them covers one of the before-mentioned ſprings. The breadth of each of them is equal to the whole width of the interval between two partitions, between which they muſt only be able to move. They are all faſtened to the ſame axis *a b*, which, as was ſaid before, paſſes through the holes *s s*, *Fig.* 57 and 59. The diameter of this axis is a full twelfth part of an inch. One of it's ends ſcrews at *a*, *Fig.* 67, into one of the aforeſaid holes *s*, and the other end, which has a flat head, is buried at *b*, in the other hole *s*; for which purpoſe the outſide of the plate is pared away a little, around this hole. One of theſe holes is ſeen at *p*, in *Fig.* 50 and 53. The valves are laid flat in *Fig.* 67, with their ſprings contracted, as in the profile *Fig.* 66. When the ſprings are at liberty, they puſh the valves out of the partitions, as far as is repreſented in the profile *Fig.* 65. But they are kept within the partitions, by a cover *a b*, *Fig.* 69, which is put into the notch *f m*, *Fig.* 59, and *e d*, *Fig.* 61; and in ſhort, into all the notches, which are upon a level with each other, from *i e* to *f k*, *Fig.* 58.

Fig. 67 is repeated in *Fig.* 69, with only the addition of the cover, which is three quarters of an inch wide, as long as the whole breadth of the bin, and not quite a twelfth part of an inch thick. It is faſtened by two ſcrews *a* and *b*, which go into the upper edge of the large partitions, as appears in the profile *Fig.* 66 and 70. *Fig.* 70 repreſents one of the large partitions of the bin, with the end *c d* of it's cover, and the head of one of the ſcrews which faſten it. *Fig.* 66 repreſents the profile of one of the ſmall partitions of a valve *e f*, of it's ſpring *a b*, and of the cover *d c*. This figure ſhews alſo, that the end of the valve cloſes with the loweſt edge of the partition; as may be ſeen more diſtinctly at *d o*, *Fig.* 67 and 69.

Fig. 68 repreſents the back of theſe ſix valves faſtened to their axis.

The end of each valve, *d*, *f*, *h*, *k*, *m*, *o*, *Fig.* 67, is bent a little outward, as in *Fig.* 71, which is only a repetition of *Fig.* 62, with the addition of the ſprings of the valves, and their cover.

The whole bin, furniſhed with the ſix valves and their axis, the ſix ſprings and their ſcrews, and the cover and it's two ſcrews, but not the axis or ſcrew which ſuſpends the bin in the box, weighs four ounces and a half.

The bin thus completed, and ſuſpended in the box, as was ſaid before in ſpeaking of *Fig.* 50 and 53, is again covered by a thin plate of braſs repreſented in perſpective at *i*, *A*, *k*, *N*, *P*, *Fig.* 53, and of which the profile is likewiſe ſeen at *i*, *A*, *s*, *k*, *Fig.* 50. This plate is bent at *A P*, *Fig.* 53, in ſuch manner that it's bended part turns inward, over the upper edge of the front of the braſs box; and it's edge, which is ſeen in profile at *A i*, *Fig.* 50 and 53, and fully at *e n*, *Fig.* 48 and 49, is faſtened to the upper part of the outer ſurface of this plate of the box, by two ſcrews *e* and *n*, which go into the holes *l* and *m*, in *Fig.* 56. This plate, from it's bending *A P*, *Fig.* 53, projects over into the box, inclining down to the bin, which it covers as low as *N k*, where the cover of the bin beforementioned, ends. This plate performs the office of a ſpring, and ſhould therefore be ſcrewed on very tight. It preſſes the bin againſt the end *q* of the ſcrew *q C*, *Fig.* 50. The breadth *A P* and *k N* of this plate, *Fig.* 53, is the ſame as the breadth of the inſide of the box; ſo that it's two edges, *A k* and *P N*, lie cloſe to the inner ſurfaces of the two large plates (*Fig.* 50 and 51.) which form the ends of the box.

Of the three Pipes of the Seed-box. PL. III & IV.

Fig. 72 repreſents a perſpective view of the three Pipes, which are ſeen partly at *B*, *D*, *E*, *Fig.* 48 and 49, and at *a b*, *Fig.* 1. They are made of plates of braſs, about a twelfth part of an inch thick, and are ſeparated from each other only by a ſimple partition. Their front is ſeen in perſpective, and on the right hand ſide of the drill, in *Fig.* 72. Their back is ſhewn in perſpective, and on the right hand ſide of the drill, in *Fig.* 53. Their front is repreſented geometrically in *Fig.* 49 and 73; and their back in *Fig.* 75. *Fig.* 74 repreſents geometrically, the ſide or profile of the middle pipe, which is inclined with the piece that faſtens it to the plate. The profile of the pipes on each ſide of this is indicated by pricked lines.

Theſe three pipes, *Fig.* 72, are ſet againſt the plate *Fig.* 56, in ſuch manner that the edges *a b*, *c d*, *Fig.* 72, are applied cloſe to it, and in the ſame order, at *i r*, *v g*, *Fig.* 56. The edges *g h*, *f e*, *Fig.* 72, are applied in like manner at *p q*, *s e*, *Fig.* 56. The line *b h*, *Fig.* 72, is ſet exactly even with *r q*, *Fig.* 56. By this means the anterior ſurfaces *b c k i*, and *f h l m*, of the two outer pipes, *Fig.* 72, exceed the bottom of the box, as at *B D*, *Fig.* 48 and 49; and the upper edges *a n*, *d o*, *e p*, *g q*, *Fig.* 72, join to the lower edges of the four partitions *Fig.* 56, at *i*, *g*, *e*, *p*, as is ſeen in perſpective in *Fig.* 53, at *x u*, *v a*, *t e*, and *s w*.

Theſe three pipes, which hold together, are faſtened to the plate by means of a ſingle braſs ſcutcheon *A*, *Fig.* 72, which is ſeen directly in front at *H*, *Fig.* 49, and at *A*, *Fig.* 73. It's fore part and right hand ſide are ſeen in perſpective at *A* in *Fig.* 72; and it's fore part and left hand ſide at *H*, *Fig.* 48. *Fig.* 75 ſhews a full view of the back part of it at *A*; and the whole profile of it, on the right hand ſide, is ſeen at *N u B L*, *Fig.* 50, and at *b d l f*, *Fig.* 74. This ſcutcheon is bent at *d* and at *m*. It's breadth is the ſame as that of the middle pipe, which is the interval between the other two, as is ſeen in *Fig.* 48, 49, 72, 73, 75. It's part *b d*, *Fig.* 74, is ſoldered or riveted to the lower ſurface of the middle pipe: from thence it takes an horizontal direction from *d* to *m*, and then aſcends perpendicularly from *m* to *f*. This length *m d* is one inch, and the thickneſs of the ſcutcheon, throughout, is about a ſixth part of an inch, or ſomewhat leſs. The thickneſs of the plate *Fig.* 56, of which the profile it here at *q l*, *Fig.* 74, is exactly embraced between the extremity *r i* of the pipe, and the ſcutcheon *f l*. The bottom, *q r Fig.* 56, of this plate, reſts upon the horizontal part *o l* of the ſcutcheon *Fig.* 74; and this ſcutcheon is faſtened to the plate by a ſcrew *p g*, which goes into the hole *n*, *Fig.* 56. It is to be obſerved, that the line *r o*, *Fig.* 74, is equal to the edges *a b*, *c d*, *e f*, *g b*, *Fig.* 72, of which it expreſſes the profile; that it's farther extent *o a*, *Fig.* 74, is equal tothe lines *b i*, *c k*, *f l*, *b m*, *Fig.* 72, of which it expreſſes the profile; and that the line *d l*, *Fig.* 74, is in the ſame horizontal plane as the line *b b* *Fig.* 72.

The angle *r*, *i*, *e*, *Fig.* 74, is of 126 degrees; and the diſtance from *o* to *i* is one third of an inch. The outſide breadth of theſe three pipes, taken together, is the ſame as that of the plate; and each of them occupies a third part of that ſpace, as in *Fig.* 53, 56, 73, and 75. Each of them is ſquare. The length of the two outer pipes, from the line *b b*, *Fig.* 72, or from the bottom *q r*, of the plate, *Fig.* 56, to the line *i m*, *Fig.* 72, or *x o*, *Fig.* 56, is one inch and a twelfth: the length of the middle pipe, *Fig.* 74, from *i*, where it joins to the plate, to it's other end *e*, is four inches and five twelfths.

Theſe three pipes are faſtened to the plate, as in *Fig.* 53. The edges *x*, *z*, *v*, *T*, *E*, *t*, *l*, *D*, *s*, *y*, of their upper openings, are circular, that they may fit exactly, and ſit cloſe to the circumference of the cylinder, which is there indicated by pricked lines, and is ſhewn in *Fig.* 50, by the line *t v f*, which expreſſes the profile of theſe edges, againſt which the cylinder rubs lightly when it turns.

Manner of working the Seed-box and of the pieces which it contains.

The line or edge *g h* of the ſix valves, *Fig.* 53, muſt be very near to the ſurface of the cellular cylinder, though not quite ſo cloſe as to occaſion a friction when the cylinder turns; and the lower end of each valve muſt anſwer to a row of cavities; ſo that the part *F* of the ſeed-box, *Fig.* 50, being filled with corn, and the cylinder turning from *b* to *r*, this laſt carries with it the grains that fall into the cavities which paſs under the edge of the correſponding valves: thoſe that fall from the two valves *a* and *b*, *Fig.* 53, are dropped, by the cavities, into the pipe *G*, in the ſpace between the pricked lines *g s* and *b t*, and are conveyed to the back of the ſhare which is on the left hand ſide of the drill; thoſe that fall from the two next valves, *c* and *d*, are dropped between the pricked lines *b t* and *d v*, into the pipe *H*, and are conveyed to the back of the ſhare which is in the middle of the drill: and thoſe that fall from the two laſt valves, *e* and *f*, are dropped between the pricked lines *d v* and *b x*, into the pipe *M*, and are conveyed to the back of the ſhare which is on the right hand ſide of the drill.

If it happens that ſeveral grains preſs together at the ſame time, at the outlet of any one of the valves, ſo as to choak it, that valve immediately gives way, lets them paſs, and is inſtantly replaced as before, by means of its ſpring which puſhes it back. No grain is ever broken by the valves: ſo that if this accident does ſometimes happen to a few, it is not during the time of actually ſowing the ſeed, but only when the drill is turned in order to begin another bout, or when the ſeedſman, inſtead of drawing the drill forward, drags it towards himſelf, and makes the cylinder turn backward.

By looſening the ſcrew *C q*, *Fig*. 50, which is at *B* in *Fig*. 1, the bin, before preſſed againſt this ſcrew by the ſpring or plate *A s k*, *Fig*. 50, is moved farther from the cylinder, the ſpace between the cylinder and the end of the valves is increaſed, and a greater quantity of corn then paſſes at a time. By turning the ſcrew *C q* farther in, the bin is puſhed nearer to the cylinder, and fewer ſeeds are dropped.

To know exactly how much the bin ſhould, at any time, be ſet nearer to, or farther from the cylinder, there is, at one of the ſides of the bin, a ſmall ſcrew, of which the head *m* paſſes through a circular opening *M N*, *Fig*. 51, in the largeſt plate of the box, where it becomes a certain guide, by means of a few equal diviſions engraved and numbered at the edge of that opening. The centre of the arch of this opening is the ſame as that of the hole *n*, upon which the bin moves.

Of the Hopper. Pl. IV.

Fig. 76 repreſents in perſpective the Hopper which is ſeen at *A* in *Fig.* 1, and of which the bottom covers the top of the ſeed-box. *D*, *Fig.* 76, is the front, and *A* the right hand end of the hopper. The boards which form the ends *A* and *B* are three quarters of an inch thick; thoſe of the ſides *D* and *C* are ſeven twelfths of an inch thick; and the thickneſs of the cover is five twelfths of an inch. The ſides and ends, which are at right angles to each other, and to the bottom, are joined together by dove-tail tenons; and the bottom is joined to the ends *A* and *B* by tenons which go into mortiſes in theſe ends, as may be ſeen on the line *b g*, The four tenons *G*, *H*, *E*, *F*, enter into the mortiſes *Q*, *R*, *S*, *T*, in *Fig.* 24, of which the dimenſions have been given. Thoſe dimenſions fix the length *g e*, or *k d*, of the hopper *Fig.* 76.

It's breadth, from outſide to outſide, at *a k*, or *b g*, is ſeven inches; and it's outſide depth *k g*, or *d e*, is eight inches and a half. The height of the legs of the hopper, from the line *b l*, where it reſts upon the upper ſurface of the table, to the line *b g*, which is the under ſurface of it's bottom, is determined by the diſtance between the top of the ſeed-box and the top of the table: It is here eight inches and a ſixth. In the middle of the breadth of the two legs, are two openings, *N* and *P*, rounded at their top, to let through them the iron axis which bears the cellular cylinder and keeps the ſeed-box ſteady under the hopper. Theſe two openings are ſeven inches high, and one inch and three quarters wide. The hopper is faſtened to the table by two hooks, one of which is ſeen entire at *L N M*, and part of the other at *P Q*. Each of them moves upon it's rivet *L*, juſt above the opening of the foot, and is bent from thence to *N*, to make room for the paſſage of the axis; after which it hooks into a ring *M* and *Q*, fixed upon the table, but not mentioned before.

Towards *D* is a ſquare opening, an inch and a half wide, cut immediately above the bottom, and through which the hopper may be emptied. This opening is ſhut by a ſmall plate of iron, or braſs, which turns like a latch, upon a ſcrew *n*, which faſtens it at that end, whilſt the other end *r*, is ſlipped down to the ſmall piece, of braſs or iron, *v x*, which is faſtened to the box by a ſcrew at *x*, in ſuch manner that the pricked part of the latch, near *r*, is covered by the end *v* of this laſt ſmall piece, which is bent for that purpoſe, ſo as not to lie quite cloſe to the box, and the edge *r q* of the farther part of the latch reſts upon the edge *x* of this ſmall piece.

Of the Fore-carriage. Pl. IV.

Fig. 77 is a perſpective view of the fore-carriage without it's wheels. It is ſeen with it's wheels in *Fig.* 1. *Fig.* 80 repreſents a geometrical plan of the inſide of one of the wheels of the fore-carriage, which is ſeen at *t Fig.* 1, and *Fig.* 81 repreſents a ſection of it. *P* and *Q*, *Fig.* 77, are the two fore-ends of the beams, to which the fore-carriage is faſtened by hooks and rings.

In *Fig.* 77, *a d* and *D E* are the two exactly ſimilar pieces which are ſeen at *S s* and *V r* in *Fig.* 1. Their length, *a d*, *Fig.* 77, is two feet eight inches; their breadth, *d A*, is two inches and two thirds, and their thickneſs is two inches. They are parallel to each other, and connected by two traverſes, *g h*, *f l*, of which the ends are tenons pinned into mortiſes in the pieces *D E*, *a d*. Theſe two traverſes are omitted in *Fig.* 1, in order to render that drawing the more ſimple. The length of theſe traverſes, excluſive of their tenons, is two feet, their breadth is two inches and a quarter; and their thickneſs one inch. Theſe two traverſes are perpendicular to the two other pieces. Their diſtance from each other, between the fartheſt outſide edge *g h* of the one, *Fig.* 77, and the fartheſt outſide edge *f l* of the other, is ſeven inches and a half. The edge *g h* is one foot ſix inches and a third diſtant from the two ends *B* and *D*.

F G is an axle-tree of which the middle part *n s* is two inches and ſeven twelfths ſquare, and of which the upper angles are cut off as in the drawing. The ſquare ſhoulders of the two ends *s n*, from whence the ſpindles proceed, project a very little beyond the outſide of the pieces *D E* and *a d*, in order that the nave of the wheels may not rub againſt theſe pieces. The ſpindles *s G*, *n F*, are eight inches and a third long, and one inch and five twelfths in diameter. This axle-tree is placed upon the pieces *D E*, *a d*, parallel to the traverſes *g h*, *f l*, in ſuch manner that the diſtance from the line *s n* to the ends *E* and *A*, is a foot and a half. This axle-tree is faſtened to the two pieces *D E*, *a d*, by two iron pins and nuts, *b q*, an inch and a ſixth ſquare, of which the ſcrew, which is ſeven twelfths of an inch in diameter, has a head an inch and a half in diameter, which lies cloſe to the under ſurface. This ſcrew is repreſented with it's nut in *Fig.* 78. Upon this axle-tree are fixed two wooden pins, five or ſix inches long, and five tenths of an inch, or a whole inch in diameter. Theſe pins are perpendicular upon the upper ſurface of the axle-tree; the ſpace between them is four

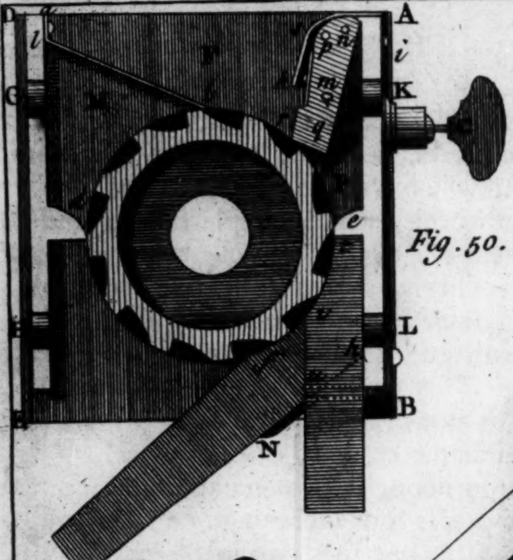


Fig. 50.

Fig. 53

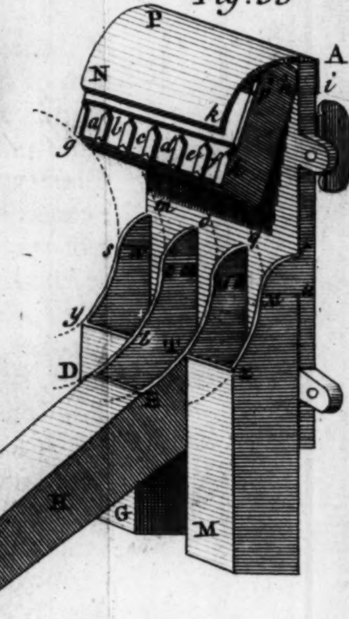


Fig. 54

Fig. 57.

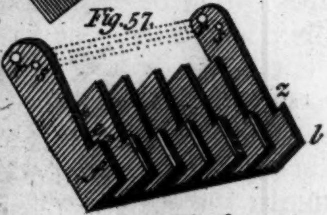
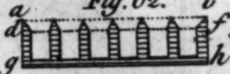


Fig. 62.



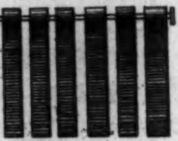
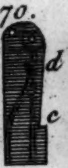


Fig. 68.

Fig. 70.



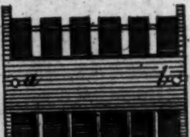
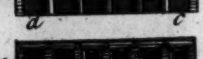


Fig. 69.

Fig. 71.



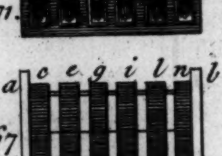


Fig. 67

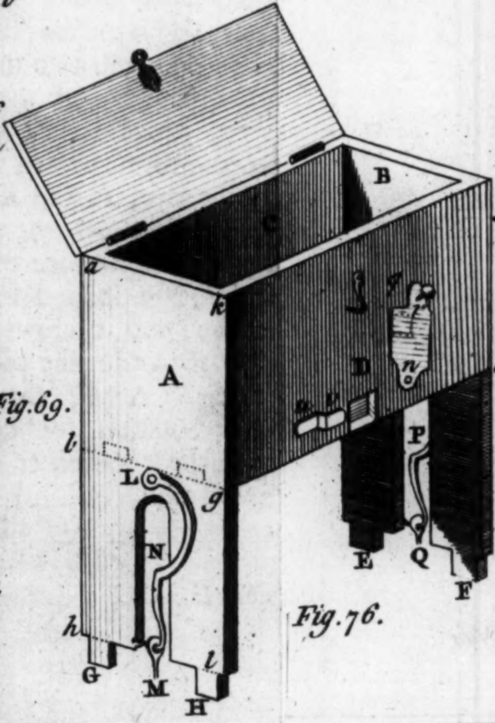


Fig. 76.

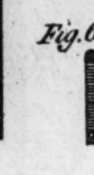
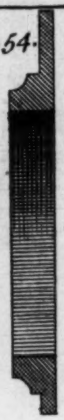


Fig. 59

Fig. 6

Sca

Fig. 54.



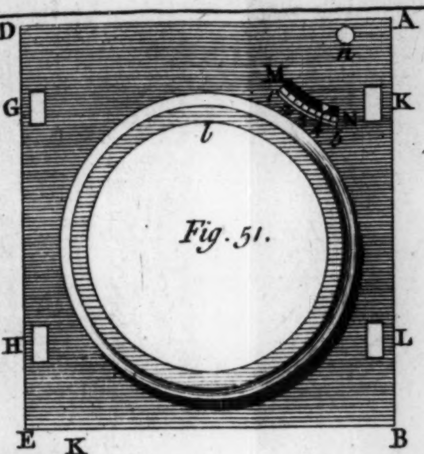


Fig. 51.

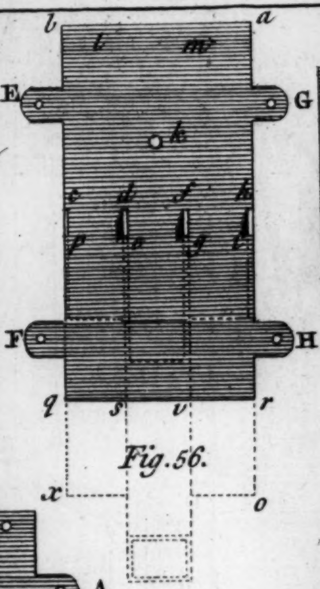
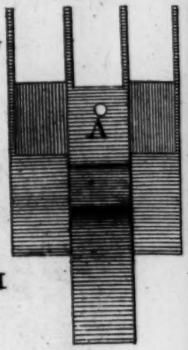


Fig. 56.

Fig. 73.



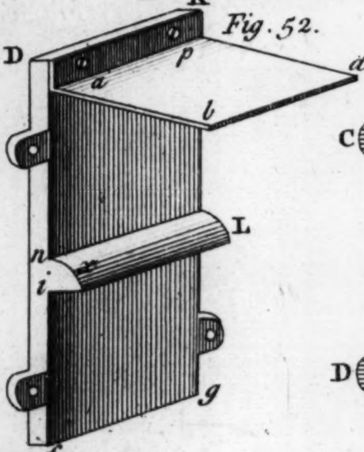
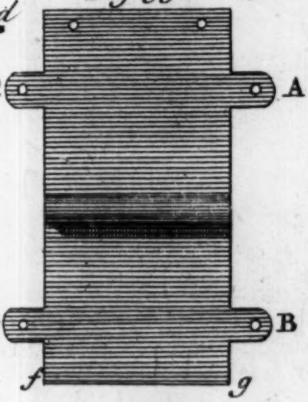


Fig. 52.

Fig. 55.



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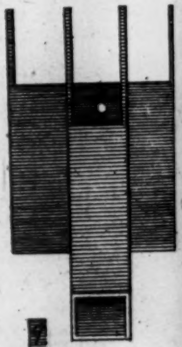


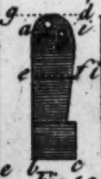
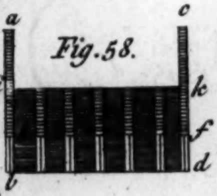


Fig. 59.



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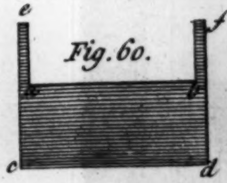
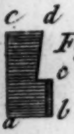


Fig. 60.



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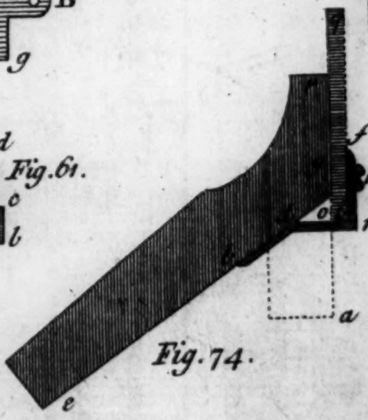


Fig. 74.

Fig. 64.

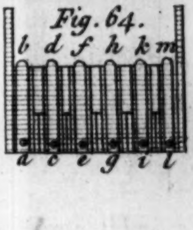


Fig. 63.

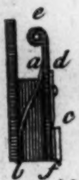


Fig. 66.

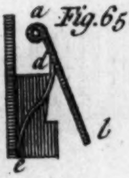
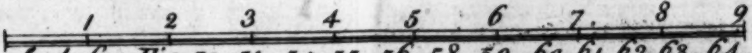


Fig. 65.



Scale for Fig. 50. 51. 54 55. 56. 58. 59. 60. 61. 62. 63. 64.
65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75 & 90

four inches, and this ſpace is in the middle of the length of the axle-tree. This axle-tree is pierced perpendicularly between the two pins, to admit another pin, which will ſoon be ſpoken of.

The two wheels, which are placed at *F* and *G*, are exactly alike. *Fig.* 80 repreſents the inſide of one of theſe wheels, with a pully fixed round it's nave, and faſtened to it's ſpokes by four ſcrews, each of which goes through the pully and one of the ſpokes. This pully is ſeen in profile at *b d* *Fig.* 81, with two of it's ſcrews.

The total diameter, *g b*, of each wheel, excluſive of it's iron hoop, is two feet and a half; that of the nave *p q* is four inches and one ſixth; that of the pully *b d* is one foot two inches and a ſixth; the thickneſs of the pully is an inch and one third; it's groove, which is cut down ſquare, is two thirds of an inch wide, and two thirds or three quarters of an inch deep. The length *p r*, or *q s*, of the nave, is ſix inches; the thickneſs of the wheel at *i n* is an inch and two thirds, and at *i b* two inches and a quarter. Of the four hooks *R*, *H*, *T*, *K*, *Fig.* 77, which ſerve, by means of two rings, to faſten the fore-carriage to the ends of the beams *P Q*, the two, *H* and *K*, are faſtened in the uſual way, by nailing them, at their flat end, upon the two pieces of the fore-carriage: but the other two, *R* and *T*, are ſhaped like a carpenter's ſquare, of which one end is ſcrewed upon the beam, in order to facilitate the putting on or taking off of the ring. At *T*, this hook is placed in it's proper ſituation for holding the ring: at *R*, it is turned the other way, that the ring may be taken off eaſily.

Of the pieces which ſupport the drill upon it's fore-carriage.

Fig. 82 repreſents in perſpective a piece of wood which ſupports the drill upon it's fore-carriage, when there is occaſion to turn it in ſowing. This piece may be called the pole. It is ſeen at *x d* in *Fig.* 1. It's end *A*, *Fig.* 82, enters into the two bridles or belts *g r h* and *a c b*, *Fig.* 26, which have been ſpoken of before, and of which one is ſeen near *d* in *Fig.* 1. It's other end, *q r*, *Fig.* 82, reſts upon the axle-tree *Fig* 77, between the two pins, as is expreſſed by pricked lines in *Fig.* 82, and as may be ſeen at *x* in *Fig.* 1.

The breadth *q r*, *Fig.* 82, of the lower ſurface of this piece, is an inch and a quarter, throughout it's whole length, to it's end *A*; and it's thickneſs throughout it's whole length *q s* is an inch and a half. It's upper angles are taken off, from the end *q r* to *s*; but from *s* to *A*, this piece is ſhaped like the two bridles or belts into which it is to enter.

It's length from *q* to *s* is one foot ſeven inches and five ſixths; and from *s* to *t*, it is two inches and ſeven twelfths. At *t*, the thickneſs of a quarter of an inch is taken off from it's under ſurface, as at *t v*; and from *v* to *A* it's length is five inches and five twelfths. It is the length *s A*, that goes into the two belts or bridles *g r h*, and *a c b* *Fig.* 26; and the notch or ſhoulder *t* is made in order to inſert a wedge whenever it is neceſſary to make the end *q r*, *Fig.* 82, reſt upon the middle of the axle-tree, in order to convey the drill the more eaſily to any diſtant part, without putting it upon it's hind-carriage, This wedge ſaves the ſeedſman the trouble of holding up the handles of the drill ſo high as he would otherwiſe be obliged to do, to make the end *q r* of this piece *Fig.* 82 reſt upon the axle-tree. It is by the help of this piece, that the ſeedſman, when he comes to the end of each bout of the drill, is enabled very eaſily to turn it in order to begin another, by lifting the drill up by it's handles; for as the end of this piece reſts upon the middle of the axle-tree, he makes the drill follow the fore-carriage which is drawn by a horſe; and as the diſtance, in this caſe, is but five or ſix feet, there is no occaſion for his making uſe of the wedge. By this means the drill is turned conveniently, and without any loſs of time.

The lines *A v*, *t s*, are even; but *q s* is inclined at *t s*, and makes with it an angle *t s q* of 166 degrees. *s a* and *g n* are two ſquare pins, faſtened by tenons into the middle of the breadth of the under ſurface *r q s*, perpendicularly to the lower ſurface *t s*. The pin *s a* is placed near the bending *s*, and the diſtance between the edges or lines *s a* and *g n*, is fourteen inches and two thirds. The breadth *a v* and *n p* of theſe pins, is an inch and a quarter; their thickneſs is two thirds of an inch; the length of *s a* is three inches and a half, and that of *g n* five inches. This pin *g n* is reſted againſt the axle-tree *F G* of *Fig.* 77, and the other, *s a*, *Fig.* 82, is placed near the table of the drill. The uſe of theſe two pins is only to hinder this piece of wood from ſlipping out of the two belts before deſcribed.

Fig. 83 repreſents in perſpective the piece of wood which ſupports the drill upon it's fore-carriage, when it is placed upon it's hind-carriage, in order to be removed from one place to another. This piece neither is, nor can be, ſeen in *Fig.* 1, which repreſents the drill in the ſtate of actual ſowing, and without it's hind-carriage. The end *A*, *Fig.*

83, goes into the belts *e f*, *g h*, *Fig*. 21, before deſcribed, like which it is ſhaped; and the end *B*, *Fig*. 83, reſts upon the axle-tree, *Fig*. 77, between the two pins. This part of the axle-tree is covered before and beneath by a ſlip or hook of iron, *B E C*, *Fig*. 83, which is nailed under the end of the piece *A B*, as in *Fig*. 84. The axle-tree, the bar, and it's hook, are traverſed by an iron pin, *D E*, *Fig*. 83, and *d e*, *Fig*. 84, which paſſes through the hole in the axle-tree, between the two pins, *Fig*. 77. The length of this piece, *A B*, *Fig*. 83, is three feet and four inches; it's breadth is two inches and a half, and it's thickneſs is one inch and a third. The pin *F G*, which is ſuſpended here, is put into the ring or bridle *L*, *Fig*: 22, and goes through the hole immediately underneath it.

Of the Hind-Carriage.

This hind-carriage is ſo ſimple that it would be needleſs to give a drawing of it. It conſiſts only of two common wheels, un-ſhod with iron, two feet eight or nine inches in diameter, ſet upon a very ſimple axle-tree, in the upper ſurface of which are two holes, into which are put the two pins before mentioned, which are under the beams of the drill. One of them is ſeen at *f h*, *Fig*. 3, and likewiſe at △, *Fig*. 1.

It is neceſſary to fix, by proper marks, the reſpective places of the ſeveral ſcrews and mortiſes of the whole machine, in order that when it is taken to pieces and put together again, none of theſe pieces may be miſplaced, or any of the helixes (or ſpiral lines) which the flat-headed ſcrews have formed in the wood, be ſpoiled.

Having found (ſays M. de Chateauvieux, in this place), *after the engraver had finiſhed all the figures above deſcribed, that ſome parts of this drill might be improved, by a few ſmall alterations, which have ſince been made; it will be right to explain them in the following figures. They may obviate ſome very ſmall inconveniencies; which, even if they ſhould ſubſiſt, are ſo trifling, that they can hardly occaſion any perceptible detriment.*

It is better to make the teeth of the harrow bend a little more than thoſe before deſcribed, and repreſented in *Fig.* 5. They ſhould bend ſo that the point *e* of the tooth may project about four inches beyond the pricked line *f*.

Figures 85 *and* 86, Pl. V, *compared with Figures* 2 *and* 31.

The mortiſe *A* in *Fig.* 85, is the ſame as that which is marked *Q* in *Fig.* 2. But the end of each beam ſhould be made about two inches wider on the inſide, and a ſecond mortiſe *B*, *Fig.* 85, ſhould be cut through it, ſimilar and parallel to the former, and at the diſtance of five ſixths of an inch, or an inch, from it, that the ſhare may be faſtened in the one or the other, according as it may be found proper to place the two fore ſhares nearer to, or farther from each other, in order to ſow the rows cloſer than they would be by the ſituation of the mortiſes *Q* and *R*, *Fig.* 2: but then the pipes which anſwer to the back of theſe two ſhares ſhould be faſtened in the manner which will be explained hereafter.

The middle piece *K L*, *Fig.* 2, ſhould project beyond the table, from *C* to *D*, *Fig.* 85, about nine inches, or a foot, and the belt or bridle *L*, *Fig.* 2, ſhould be ſuppreſſed. This ſame piece ſhould have, in it's part *E F*, *Fig.* 85, nearly the ſame breadth as the end of the beams *H*, *I*; and two mortiſes, *E*, *F*, inſtead of one, in which the ſhare, thicker than was ſaid before in it's upper part, is to be faſtened by two tenons and a key. The pipe which terminates behind this ſhare, inſtead of paſſing ſide-ways, as in *Fig.* 31, will go ſtraiter and more eaſily through the hole *G*, *Fig.* 85, which is ſeen at *K*, *Fig.* 86, and from thence through the thickneſs of the ſhare, which will be pierced for this purpoſe from *K* to *G*. The ſole of this ſhare, from this hole to it's bottom, will be of the ſame thickneſs as was mentioned before.

Figures 87 *and* 88, Pl. V, *compared with Figures* 29 *and* 30.

The upper openings, *f d*, *b o*, *Fig.* 29, of the two foremoſt pipes ſhould be joined by a good hinge *A*, *Fig.* 87, well ſoldered to them, and of which the pin, ending with a ring at one end, may eaſily be taken out. By means of this hinge, theſe two pipes may be ſet cloſer together, or farther aſunder, like the legs of a compaſs, and be fitted to the different ſituations of their ſhares. The faſtening of the lower end of theſe pipes will be nearly the ſame as was deſcribed in *Fig.* 30; with this difference, that inſtead of bending the ſquare *k i g* of that *Figure* only at *i*, upon it's upper ſurface, and making it's part *k i* run lengthways of the beam *E F*; here, *Fig.* 88 is twiſted as it were in it's bending, in order that the part *s n* may lie a-croſs the beam, and lengthways of the table. In this caſe, if the ſhare *A* be put into the mortiſe *B*, the part *s n* muſt be ſlipped farther, till the hole *s* can be faſtened at *n*, by the thumb-ſcrew which is at *n*: and as this part, being held only by a ſingle ſcrew, might be apt to looſen and jog, a piece a piece or ſlip of iron, *a v*, is permanently fixed at it's edge, ſo as to keep it tight in either of it's ſituations. The ſcrew *n* faſtens in a nut ſunk into the upper ſurface of the beam, where this nut is permanently fixed, and covered by the table. There ſhould likewiſe be two holes in the other part of the ſquare, towards *q*, to ſerve for the two different ſituations of the ſhare. The pipes of the ſhares are more eaſily made round, as here repreſented, than ſquare, as was directed before.

Figure 89 *compared with Figure* 35.

Inſtead of the ſmall grove *u*, *Fig.* 35, in the braſs cylinder, intended for intróducing a little oil to that part; a more ſimple way will be to bore a perpendicular hole *p*, *Fig.* 89, through the head of the ſtandard, down to the ſpindle; and this hole may be covered by a ſmall plate *A*, made to turn upon a ſcrew or rivet.

Figures 90, 91, 92, 93, *and* 94, *compared with Figures* 50 *and* 53.

As the three pipes or funnels *G*, *H*, *M*, *Fig.* 53, embrace, at their upper opening, only a ſmall part, *f*, *t*, *Fig.* 30, of the cellular cylinder, ſome grains may chance to be loſt on the ſide where this cylinder is not covered, from *d* to *f*. To prevent this inconvenience, they may be made ſo as to embrace the whole lower ſemi-diameter *d f t* of the cylinder, in the manner repreſented in *Fig.* 90, 91, 92, 93, 94.

The firſt funnel, which is ſeen geometrically at *A*, *B B*, *Fig.* 90, is repreſented in perſpective, and of a ſmall ſize, in *Fig.* 93, where its correſponding parts are marked with the ſame letters *a*, *b b*. This is the funnel *M* of *Fig.* 53. The ſecond large funnel, of which a part appears at *D*, *Fig*. 90, is ſeen entire and in perſpective, in *Fig*. 92, where the ſame part is marked *d*. This is the funnel *H* of *Fig*. 53. Two ſcutcheons, *g* and *p* are ſoldered to this funnel, and faſten it, by ſcrews, to the fore and hind inner ſurfaces of the box, as at *P G*, *Fig*. 90. The third funnel, which does not appear in *Fig*. 90, and which is like the firſt, is repreſented in *Fig*. 91. This is the funnel *G* of *Fig*. 53. Theſe three funnels are made ſeparately, of very thin plates of braſs, bent, and well ſoldered; and are afterwards firmly rivetted to each other, ſide to ſide, as in the perſpective *Fig*. 94. They are ſo tightly joined, that the ſcutcheons *g p*, *Fig*. 92 and 93, are alone ſufficient to hold them all in their proper places.

Figures 95 *and* 96 *compared with Figure* 66.

In the repreſentation of this part in *Fig*. 66, the valve *e f* is actually cloſed by it's ſpring *a b*, to the cover *d c*, and in this ſituation it is ſhut: but when the corn preſſes againſt this valve, and forces it into the ſituation *a b*, *Fig*. 95, a grain may jump ſo as to get between the valve and the cover, and thereby hinder the valve from cloſing again; ſo that more corn would continue to run out. To guard againſt this accident, each valve muſt have a ſmall tongue *p* immediately below the cover, and the cover muſt be bent in that place, to receive the tongue when the valve cloſes, Both of theſe are repreſented ſeparately in perſpective, in *Fig*. 96.

Figure 97 *compared with Figures* 50 *and* 51.

Inſtead of the index *m*, *Fig*. 50, and the graduated opening *M N*, *Fig*. 51, an eaſier and more

Fig. 77.

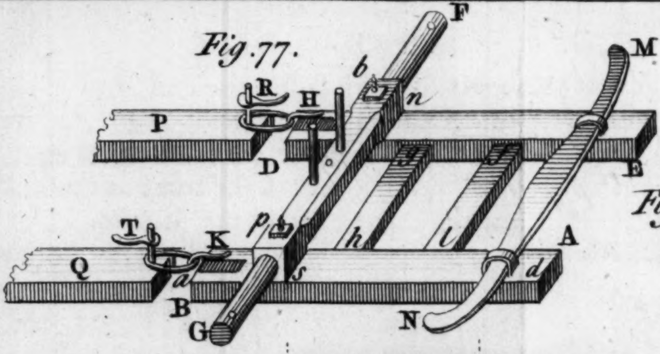
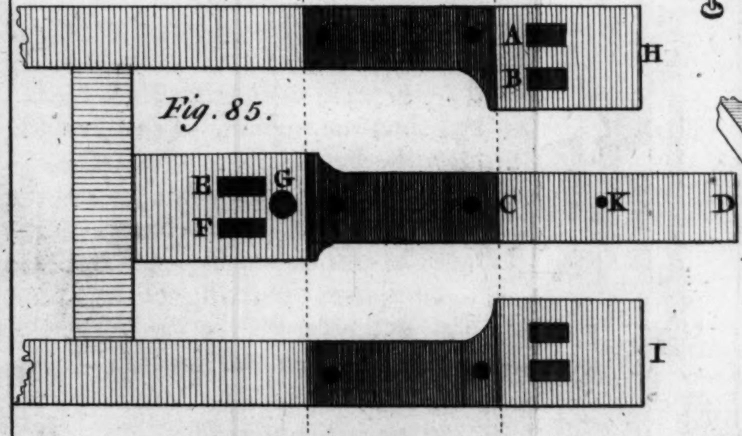


Fig. 79.

Fig 7



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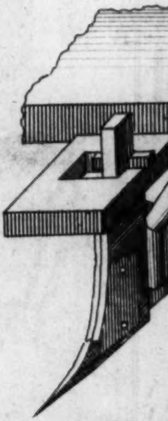

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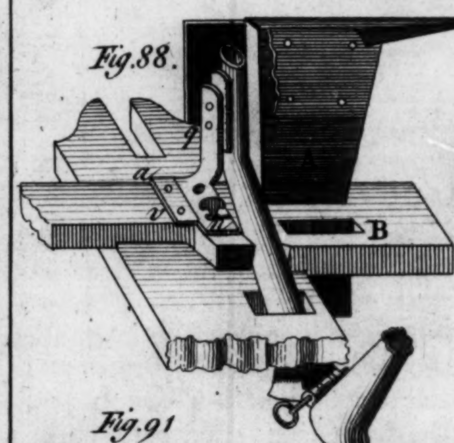


Fig. 89.

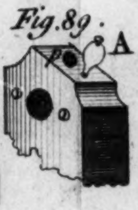
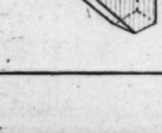


Fig. 91



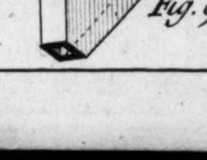


Fig. 92.

Fig 93

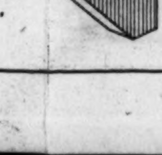
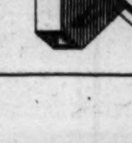
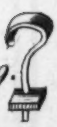


Fig. 9





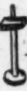
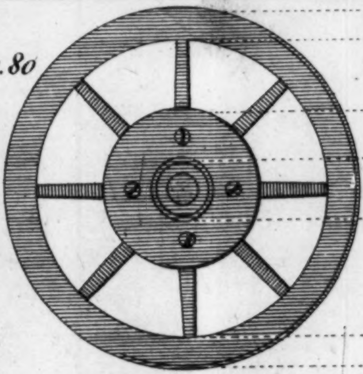


Fig 78.

Fig. 80


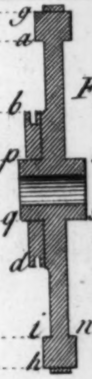


Fig. 81.

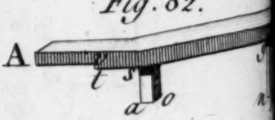
Fig. 82.


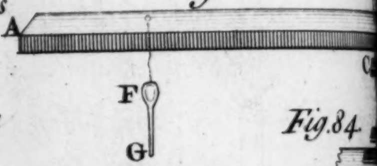
Fig. 83.


Fig. 84

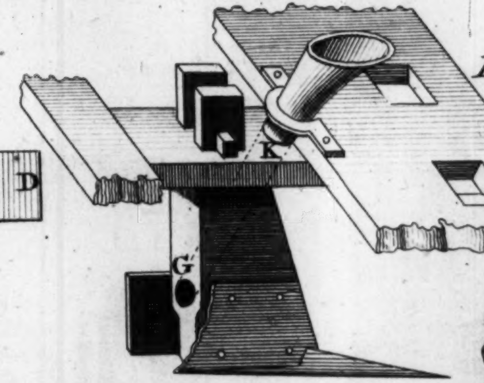


Fig. 86.

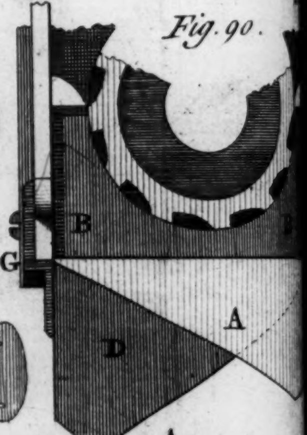
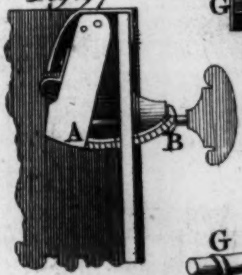
Fig. 90.


Fig. 97


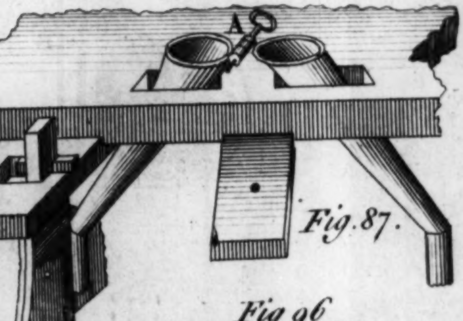


Fig. 87.

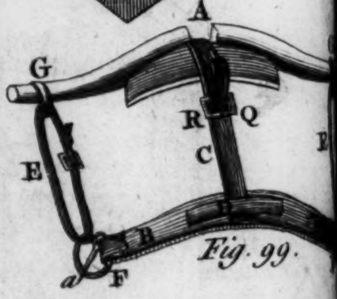


Fig. 99.

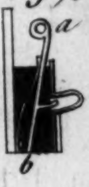
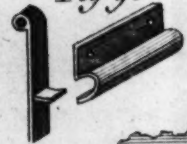
Fig. 95.


Fig. 96


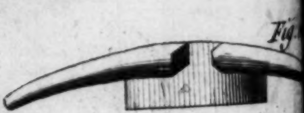


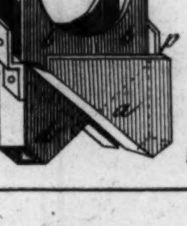
Fig. 94.


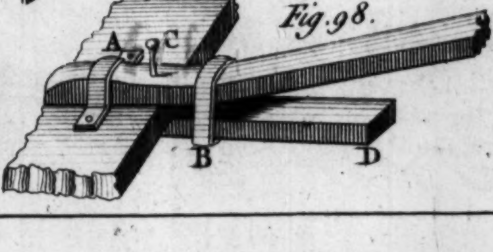
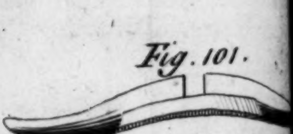
Fig. 98.


Fig. 101.


ſimple way will be, to faſten the end *A* of a graduated limb or border of a circle, *A B*, *Fig.* 97, to the bin, in ſuch manner that it's other end *B* may project through a hole in the front of the braſs box. This will mark exactly the ſituation of the bin.

Figure 98 *compared with Figures* 82, 85, 21, 26.

When the middle piece is lengthened, as at *C D* *Fig.* 85, there is no occaſion for the ring or bridle *L*, *Fig.* 2, and *f k* *Fig.* 26, or for the pieces *s a* and *g n* *Fig.* 82; and then the pole *A*, of this *Fig.* 82, will paſs through the belt *A*, *Fig.* 98, and through another belt *B*, which laſt goes round it and the piece *D*. This belt is fixed by two ſcrews under the piece *B D*. The pin *C*, which penetrates into the table, will complete the fixing of this pole. The hole *K* *Fig.* 85, receives the pin *F G*, *Fig.* 83, which goes through the two pieces *C D* *Fig.* 85, and *A B*, *Fig.* 83.

M. DE CHATEAUVIEUX's

Inſtructions concerning the Manner of uſing his

DRILL-PLOUGH[a].

" THIS Drill is repreſented in *Fig.* 1, with all it's parts put together, in a ſtate fit for working. When the thongs which encompaſs the grooves of the pullies *Q P* of the axis in *Fig.* 1, and thoſe of the fore-carriage *u t*, are ſtretched properly, and the hopper is filled with corn, a horſe is to be harneſſed to the ſpring-tree bar, and an intelligent man, who can walk a good pace, ſhould guide this horſe, which ſhould be a mild, tractable creature.

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[a] DUHAMEL, *Culture des Terres*, *tom.* III. *c* 2.

"The ſeedſman will hold the handles of the drill, in order to direct it: and he will warn the guide whenever he deviates from the ſtrait line in which he ought carefully to keep. He will alſo obſerve, from time to time, whether the diſtribution of the ſeed is not ſtopped by ſome unexpected accident: for he can ſee the end of the pipes through which the grain ſhould drop; beſides which, the corn makes a little noiſe in paſſing through the pipes, and he may eaſily hear it. The ſeedſman will take particular care that the thongs do not ſlip out of the grooves of the pullies; and if they do, he will replace them inſtantly: but this accident is very rare; nor, indeed, does it hardly ever happen, unleſs the thongs are new, and have not yet been ſufficiently ſtretched. It is proper to obſerve here, that we have tried hempen ropes, and ſmall iron chains: but thongs of leather are much better than any other thing.

"Care ſhould be taken, that the ſeed corn be free from grit, dirt, or little ſtones; for either of theſe might damage the valves of the bin. If the corn has been ſteeped in lime-water, as is the practice of ſome farmers, in hopes of preſerving their crops from ſmut, it muſt not be ſown till it is ſo dry that the grains will ſlip eaſily over one another.

"The ſeedſman will be particularly careful to repleniſh the hopper before it is quite empty.

"He will oil the ſpindles of the axis once or twice a day; obſerving that they require moſt frequent oiling when the drill works in dry ground, which ſends up a very fine duſt: and he muſt cleanſe the ſpindles and the pipes in which they turn, every morning, by rubbing off the old oil, and putting on new. He will alſo, from time to time, cleanſe the ſpindles of the axle-tree of the fore-carriage, and rub them with ſoap. If any rain happens to fall during the time of ſowing, he muſt wipe the drill very dry, as ſoon as he has got it home, and particularly about the axis, to prevent it's ruſting. It is even highly proper to have a leather covering to put over the table and all the parts upon it, and likewiſe over the ſtandards, the axis, and the hopper. It is eaſy to conceive the proper cut of this covering.

“ The prudent huſbandman ſhould always have with his drill, a ſmall box, containing a hammer, a pair of pincers, a turn-ſcrew, thongs, ropes, nails, iron rings and buckles, a little bottle of oil, and other ſuch like things; in order that, if any of them ſhould be wanted in the field, he may not loſe time by being obliged to ſend home for them.

“ The ſeedſman will obſerve, when he is going to ſow, not to leave the wedge *t*, *Fig*. 24, under the pole, in order that the end *c*, *Fig*. 1, may not preſs upon the axle-tree of the fore carriage. (The only uſe of the pole, at the time of ſowing, is to turn the drill when a ſecond bed is to be ſown after the firſt is finiſhed, and ſo of others.) It is eaſy to conceive, that if this end of the pole ſhould make the drill reſt upon the axle-tree, it might often happen, that, by it's being thereby too much ſubjected to the motions of the fore-carriage, the ſtones or clods which the wheels may meet with, would, by raiſing them higher than the general ſurface, throw the ſhares out of the ground, or at leaſt occaſion the furrows to be ſhallower in thoſe places; things which ought by all means to be avoided.

“ We have repreſented but one ſpring-tree bar in *Fig*. 1, becauſe we think a ſingle horſe may be uſed, without any inconvenience, when the ground is not too much loaded with wet: but if the land be too full of water, two horſes muſt be put to the drill, which, in that caſe, muſt have a double bar, the manner of ordering which is too well known to need any deſcription. Each horſe will then go in a furrow, and they will not poach the bed, as would be the caſe, in wet land, if the drill was drawn by only one horſe, whoſe ſteps are determined by the middle of the bed.

"For want of horſes, oxen may be uſed, and the ſowing may be performed equally well.

"It is proper to obſerve, that the quantity of ſeed diſtributed by the drill is exactly the ſame, whether the horſes or oxen go faſt or ſlow. If, for example, one bed is ſown in ten minutes, and twelve or fifteen minutes are employed to ſow another, of equal dimimenſions, neither more nor leſs ſeed will be dropped in one, than in the other; becauſe the revolutions of the cylinder, *Fig.* 39, are invariably regulated by thoſe of the wheels of the fore-carriage, whoſe circumference, be it turned quick or ſlow, will always deſcribe a line of equal length, and the cylinder turns exactly with theſe wheels. The only difference that can ariſe from the greater or leſs ſpeed of the horſe, is the gain or loſs of time: but the quantity of ſeed ſown will be conſtantly the ſame, ſo long as the drill remains ſet in the ſame manner.

"The greater or leſs goodneſs of the ſoil, it's having been well or ill prepared for ſowing, it's ſtate of dryneſs or humidity, and ſeveral other circumſtances which ſhould be carefully attended to, will oblige the huſbandman ſometimes to vary the quantity of ſeed. The drill is accordingly made to diſtribute more or leſs, by the means before mentioned, of placing the bin nearer to, or farther from the cellular cylinder, by turning the ſcrew *L*, *Fig.* 50. By ſetting the bin farther off, a greater quantity of ſeed is dropped; and by bringing it nearer, a leſs proportion is ſown. It will be eaſy to find the proper diſtance at which to fix it, in order to it's giving out exactly the deſired quantity of ſeed.

" Though this method affords a pretty wide latitude, it may ſometimes not be ſufficient. This is a caſe which will very ſeldom happen, and which we have not yet met with: but if it ſhould at any time take place, the drill may eaſily be made to diſtribute ſtill more or leſs ſeed, by changing the pullies of the axis *Fig.* 39, for others of a larger or ſmaller diameter, which will either acccelerate or retard the motion of the axis, in proportion to their ſize.

" We will ſuppoſe, for example, that the pullies are but of half the diameter of thoſe before deſcribed. It is evident that theſe ſmaller pullies will make the axis turn round twice, where it turned but once with the former, and that double the quantity of ſeed will conſequently be dropped on the ſame length of ground. By the ſame rule, pullies twice as large will turn the axis but half the number of times, and but half the quantity of ſeed will of courſe be let fall, in the ſame ſpace. The proportion of the ſeed ſown may likewiſe be increaſed or diminiſhed, by a greater or leſs number of cavities in the cellular cylinder; and the changing of this cylinder is ſoon and eaſily performed: but, as was ſaid before, there will very ſeldom be any occaſion for theſe alterations.

" The furrows opened by the ſhares of the drill, and in which the ſeeds are depoſited, ſhould be of different depths, in different caſes; and this may be effected by means of the rings which faſten the drill to it's fore-carriage at the hooks *R H*, *T K*, *Fig.* 77. For general uſe, the diameter of about three inches, from inſide to inſide, will be ſufficient for theſe rings, and then the furrows are made about three or four inches deep. They will be opened deeper by uſing rings about four inches in diameter; and it is immaterial whether they are round or oval. With ſmaller rings, the furrows will be made ſhallower; and their depth may alſo be diminiſhed, by making the horſe draw with longer traces, or by uſing a lower horſe.

"If very ſhallow furrows are wanted, or only juſt the ſurface of the ground is intended to be opened, the wedge *t*, *Fig.* 24, muſt be put under the pole. In ſhort, a little practice will ſoon ſhew the huſbandman how to manage this drill in every reſpect, and make him thoroughly acquainted with all that is neceſſary to be known in regard to the diſtribution and proper covering of the ſeed, which laſt part is perfectly well performed by the teeth of the annexed harrow.

"If any thing ſhould ſtill ſeem obſcure to thoſe who have read attentively and ſtudied the deſcription of each part of this drill; let them but ſet actually to work, and their ideas of it will ſoon be perfectly clear. Each part, taken ſeparately, may be made with great eaſe: their ſizes, ſhapes, and proportions are pointed out, in ſuch manner, that no workman of common underſtanding can miſtake; and when the parts are conſtructed, there can be no difficulty in putting them together, if the foregoing directions are but obſerved."

"*Deſcription of a Harneſs, to yoke Oxen one before another.*" Pl. V.

"The utility of being able to put oxen to this drill, in ſuch manner as to make them go one before another, in the furrow, without treading upon the places which are to receive the ſeed, firſt put me upon contriving a harneſs proper for theſe cattle: for I was not ſatisfied with thoſe I had ſeen in different countries. Two of my teams of oxen, harneſſed in my new manner, have worked the whole year; ſeveral perſons have adopted the method; and I am more and more pleaſed with it. This harneſs is very ſimple, and very light, and does not ſubject the ox to any irkſome confinement.

"*Fig.* 99 and 100 repreſent the whole of this harneſs, that is to ſay, it's plan and a view of it. *Fig.* 99 ſhews it to be compoſed of a yoke *A*, which the ox bears upon his head, and which is there faſtened to his horns by long thongs. The reſt of the harneſs is of leather. The piece *B*, is the principal part, and that by which the ox is to draw. It reſts againſt his neck a little below the withers, and ſits extremely cloſe to the neck when the ox draws. If it be made of double leather, there is no occaſion for the piece of leather *D*, which ſerves only to ſtrengthen it when it is ſingle. The thong *C* faſtens in the buckle *Q R*, which is fixed to the yoke by another thong. The uſe of theſe is to hinder the large piece of leather *B*, from riſing above the withers, when the ox toſſes his head, or raiſes his neck. Care ſhould be taken not to ſtretch the thong *C* too much, for the ox muſt not draw by it.

"The thongs *E E*, with their buckles to lengthen or ſhorten them ſerve, to make the ox draw by the yoke, by putting them through the large iron buckles *F F*, and the leather buckles *G G*, which muſt be nailed to the yoke. The length of theſe thongs is ſuited to the purpoſe for which they are intended.

"My traces are made of ropes, and I find them convenient. At one end of them is part of a leathern trace, about fifteen inches long, like the end of the harneſs of a coach-horſe. This end is put through the large buckles *F F*, where it is faſtened by the tongue *a a*: ſo that the trace may eaſily be ſhortened or lengthened."

M. Duhamel, after obſerving, in his Elements of Agriculture[a], that there is no fault in M. de Chateauvieux's Drill-plough, but the price, which may render the purchaſe of it inconvenient to ſome huſbandmen, gives us the following, conſtructed upon the ſame principles, but in a cheaper and more ſimple way, by M. de la Levrie, one of his correſpondents.

Fig. 1, 2, 3, 4, 5, *&c.* repreſent this Drill-plough in *Pl.* VI. In *Fig.* 2, the ſhares are two inches deep in the ground, to ſhow the ſituation of this inſtrument when it works.

This Drill-plough is compoſed of a fore and a hind-carriage. The fore-carriage, pretty much like that of a common plough, but a great deal lighter, has upon it's axle-tree a ſmooth flat piece of wood *a*, *Fig*. 1 and 2, fourteen inches long, three inches thick, and five inches wide; but lowered at it's two ends, for the ſpace of three inches, ſo as to be reduced there to two inches, in order to their being trimmed with thin ferrules, which ſerve to keep the axle-tree in it's box, as is practiſed with the axle-trees of coaches.

Upon it's middle part, where it retains it's whole thickneſs, is fixed, by two tenons, the ſaddle, which is a board *b*, *Fig*. 1 and 2, about eight inches high, an inch and a quarter, or an inch and a half thick, ſix inches long at the bottom, and four inches at it's top, where a round notch is cut in it, to the depth of ſour or five inches. This notch is made to receive the pole.

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[a] *Tom*. II. *p*. 56—68.

In the middle of the piece *a* is a mortiſe, cut quite through, two inches wide, and three inches long, which ſerves to unite the head-piece and the yoke; theſe being made of two ſeparate pieces. The head-piece *c* and the yoke *d* thus united, may, if it pleaſes better, be made of only one piece two feet and eight or nine inches long, three inches wide, and two inches thick, The part which is lengthened about eight inches behind the piece *a*, makes the yoke. From thence forward and underneath, a groove is cut three inches deep and one inch wide, to receive the lower cheek of the mortiſe of the piece *a*. There remains at top an opening of an inch, which is filled by a key, twice as long before as it is behind, and which is faſtened by a pin afterwards cut cloſe.

The ſpring-tree bar, *e*, *Fig.* 1 and 2, is made as uſual. The wheels, conſiſting of a nave, ſix ſpokes, and ſix circular pieces, are two feet and four inches in diameter. They ſhould be made as light as poſſible. Their dimenſions may be taken from the engraved figure, where their proportions are marked. An iron hoop, about a twelfth part of an inch thick, may be put around theſe wheels, to ſtrengthen their joints, and keep them round.

The naves are four or five inches in diameter in the middle of their length, which is eleven inches. They leſſen towards the outſide end, as uſual. At two inches from the thick end is a ſhoulder, againſt which are placed the pullies *s*, which are an inch and a half thick. A ſpace of half an inch remains, to fix them; which is done by three ſmall pins. The diſtance between theſe pullies, when the wheels are in their proper places, ſhould be ſixteen inches and a half, from the middle of one to the middle of the other.

Theſe pullies are eight inches in diameter, from the bottom of their groove, which is five twelfths of an inch wide. Whether theſe grooves be rounded within, for ropes, or whether they are cut down ſquare, for thongs of leather, their ſize ſhould be exactly equal.

The body of the axle-tree is made of a bar of iron an inch ſquare; but it is rounded at each end. The body is let into the bottom of the piece *a*, and is held by the two ferules before mentioned.

The hind carriage is compoſed of two beams *g g*, *Fig* 1, three feet long, two inches broad, and an inch and a half thick. They are connected, at one inch from their fore-ends, by a traverſe *h* placed upon the beams, where it is faſtened by means of a ſhoulder *i*, *Fig.* 1, cut half an inch deep in its lower ſurface, and fixed by two ſmall ſcrew-pins with nuts. This traverſe is an inch ſquare; except in the middle, where it is lowered a little, to receive the pole which is to reſt upon it.

At ten inches from the fore-end, the beams are again connected with two tenons and a tongue, by a table *k*, *Fig.* 1, ten inches wide and an inch and a quarter thick; and at one foot from the hind-end, theſe beams are likewiſe connected by a traverſe *l*, *Fig.* 1, an inch and a half wide and an inch and a quarter thick, which ſuſtains the hinder part of the ſeed-box, and bears the hook which keeps that box ſteady at the time of ſowing, and alſo holds it up when the quantity of ſeed is to be leſſened. This traverſe and the table lie flat to the under ſurface of the beams.

Behind this traverſe, and as near it as the oblique direction of the mortiſes will permit, are faſtened the handles *m*; nearly of the length, and according to the bending, which may be taken from *Fig.* 2. They are ſupported at the end of the beams by the prop *n*, *Fig.* 2, and joined by the traverſe *o o Fig*, 1, The diſtance between the beams is twenty one inches: ſo that the hind-carriage, is two feet wide from outſide to outſide.

Towards the fore part of the beams are placed two ſtandards *p*, *Fig.* 1, which ſerve to ſupport the two ſmalleſt pullies. The middle of theſe ſtandards is eleven or twelve inches from the end of the beams. They are four inches wide at their baſe, and about two inches and a half, or three inches, towards the top; their height is five inches and a half, and they are an inch, or an inch and a quarter thick.

In the top of theſe ſtandards is a ſlit or groove *q*, an inch deep, and four or five inches wide, in which turn the iron trunnions of the ſame thickneſs as the wooden axle-tree *r*, *Fig.* 1 and 5, which is turned to the diameter of two inches at the places marked *r*. The ſame axle-tree bears the axis *q*, the parts *r*, the correſponding pullies *s*, and the cylinders *t u*, *Fig.* 5.

Theſe correſponding pullies ſhould be four inches in diameter from the bottom of the groove, which is five ſixths of an inch wide, and two thirds of an inch deep. Theſe pullies ſhould be placed at the ſame diſtance from each other as thoſe of the fore carriage, to which they anſwer.

The ſhares *u u*, *Fig.* 2, are two inches thick, and five inches and a half wide at their ſhoulders under the table, including five ſixths or eleven twelfths of an inch for the depth of the groove, which makes the channel marked by the pricked line *u*, and five twelfths of an inch for the thickneſs of it's cover. Theſe ſhares are inclined with their point backward. A perpendicular line drawn from their point to the bottom of the table, will be twelve inches long; and from this perpendicular to the point where the pricked line *u* touches the table, is four inches.

The fore part of the ſhares is cut chanfrin-wiſe on both ſides. This chanfrin begins three or four inches below the table, and makes a ſtay at right angles. This ſtay is trimmed from the point to the height of ſix inches, with a piece of well-hammered and ſteeled iron one ſixth or a quarter of an inch thick, of which the edges, thinned with a file, are riveted one upon the other; and this trimming is faſtened on each ſide by four flat-headed ſcrews.

The channel is open and ſloped behind down to the point, from the height of three inches and a half, or four inches; as in *Fig.* 2.

The tenons *x x*, *Fig.* 1 and 2, which fix the ſhares to the table, are three inches and a half long, and two inches and a quarter of this length riſes above the table. Their thickneſs is an inch and a half ſquare, and they are ſecured at top by iron keys, which reſt upon plates of iron one ſixth of an inch thick. The key of the middle ſhare is placed lengthwiſe of the table, and the others are placed croſswiſe.

The two pricked lines *u*, *Fig.* 2, repreſent the breadth of the channel, which is five ſixths of an inch every way. This channel ſhould anſwer, under the table, to the openings made in the table, to communicate with the hoppers which are under the cylinder.

Theſe ſhares will do very well in land which has been plowed deep and brought to a fine tilth: but when the ground is hard, it will be neceſſary to uſe ſhares like thoſe of M. de Chateauvieux's drill.*

The fore part of the hind-carriage terminates with the pole *t*, *Fig.* 1 and 2, which is made of a ſingle piece of wood three feet three or four inches long, two inches and a half thick at the diſtance of fourteen inches from it's lower end, and rounded from thence to the other end, where it's diameter is but two inches.

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* See *Pl.* II. *Fig.* 12—20; and *p.* 38—41, of this Volume.

The pole is fixed to the foreſide of the table by a ſcrew-pin with a nut. It reſts upon the traverſe *b b*, *Fig.* 1, where it is again held by a ſcrew-pin and a nut; and it is faſtened to the fore-carriage by the collar *f f*, *Fig.* 1 and 2, which is either of iron or of wood. It's fore end reſts upon the ſaddle *b*, *Fig*, 2. The draught is not made by the pole, but by the cords or thongs, which encompaſs the pullies of the fore-carriage, and the correſponding pullies of the cylinder.

The hoppers *z*, *Fig.* 1 and 6, are fitted to the table, in ſuch manner that their outlets anſwer to the channels *u* which are behind the ſhares, in order that the ſeed which falls into theſe hoppers may be depoſited in the furrows as faſt as they are formed by the ſhares. It is proper to obſerve here, that the hoppers are not faſtened to the table, but to a board which is placed upon the table, and which ſlides between two brackets. By the help of this board, the ſeed-box, the cylinder, and all the pieces belonging to them, may be ſhoved forward, as will ſoon be ſeen, when it is thought proper to ſtop the ſowing.

The ſeed-box *A*, of which the tranverſe ſection is ſeen in *Fig.* 2, an oblique ſection in *Fig.* 3, and the back part in *Fig.* 4, is made of boards about one third or five twelfths of an inch thick. It is about fourteen or fifteen inches high, and twenty one inches wide at *E E*, *Fig.* 4. It is ſhaped ſo that it's bottom *B*, *Fig*: 2, 3, and 4, is inclined and ſloped at the edge, in ſuch manner as to be fitted to join exactly to the cylinders *t u*, *Fig.* 3 and 5. The partitions which are ſeen above the letters *C*, *Fig.* 4, are ſo many ſmall boards, faſtened to the inſide of the hinder ſurface *D D* of the box. They are cut in circularly, ſo as to join exactly to the circumference of the cylinder, without obſtructing it in any ſhape when it turns. By ſhifting the ends of the cylinder, that is to ſay, by putting each end in the place where it's oppoſite end was before, either the large cavities *t*, or the ſmall ones *u*, may be ſet between the cheeks or partitions *C*.

Let us now ſee the manner in which this inſtrument works. The cover *E*, *Fig*. 2, of the box *A*, is lifted up in order to fill it with ſeed, through the opening *F*. This ſeed falls upon the inclined plane *G*, and paſſes through the opening *H*, at the angle *B*, where it is ſtopped by a ſmall board *B*, which is the ſame as *C* in *Fig*. 4, and by the circumference of the cylinder. It is for this reaſon that, as I ſaid before, this plate *C*, and the partitions ſhould cloſe exactly with the cylinders *t u*, *Fig*. 5. When the cylinder turns, the cavities around it's circumference are filled with the corn which falls between the partitions, and, in turning, drop it on the ſide *I*, *Fig*. 2, from whence it runs down the inclined plane *L*, and goes into the channel *u*. *Fig*. 2, at the back of the ſhares, where it is depoſited in the furrow.

Fig. 6, repreſents the three hoppers *z*, which are placed upon the table, of which the inclined plane *L*, *Fig*. 2, is one of the ſides. As the ſhares are fixed under the table, and the middle ſhare is placed more forward than the two others, the diſpoſition of the outlets *y* of the hoppers, *Fig*. 6, muſt anſwer to the inlets of the ſhares, in order that the ſeed which drops through thoſe outlets may be conducted to the channels *u*, *Fig*. 2.

The ſeed-box may be inclined forward, as is indicated by the pricked lines *M*; and it may be held at different degrees of inclination by the piece of iron *N*, *Fig*. 2, by which means more or leſs ſeed

may

Fig. 1.

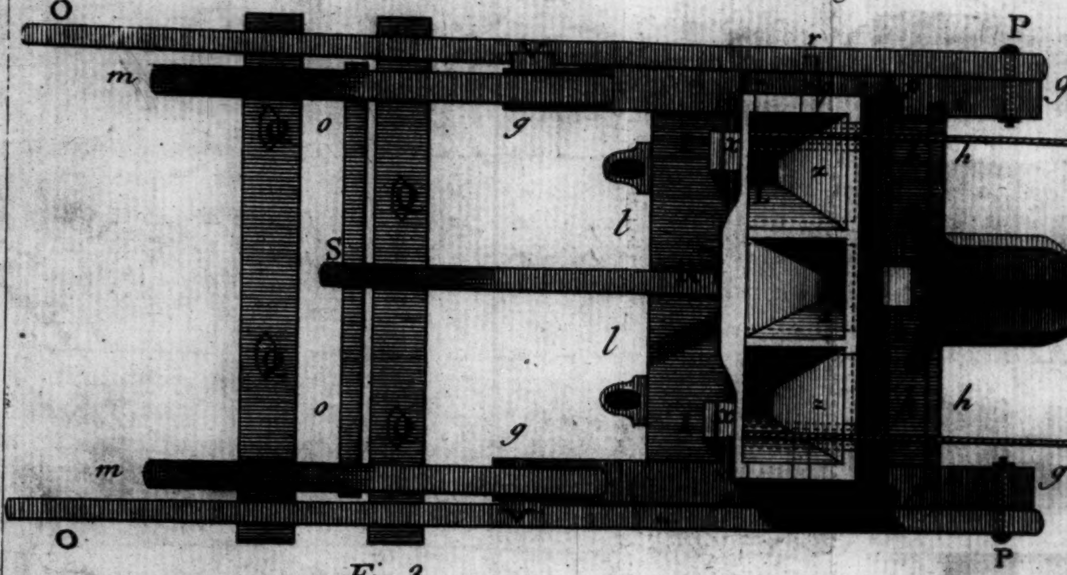


Fig. 3.

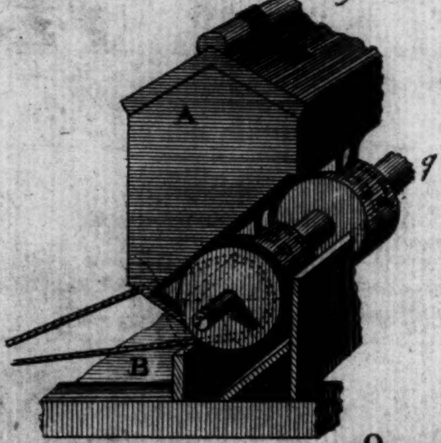
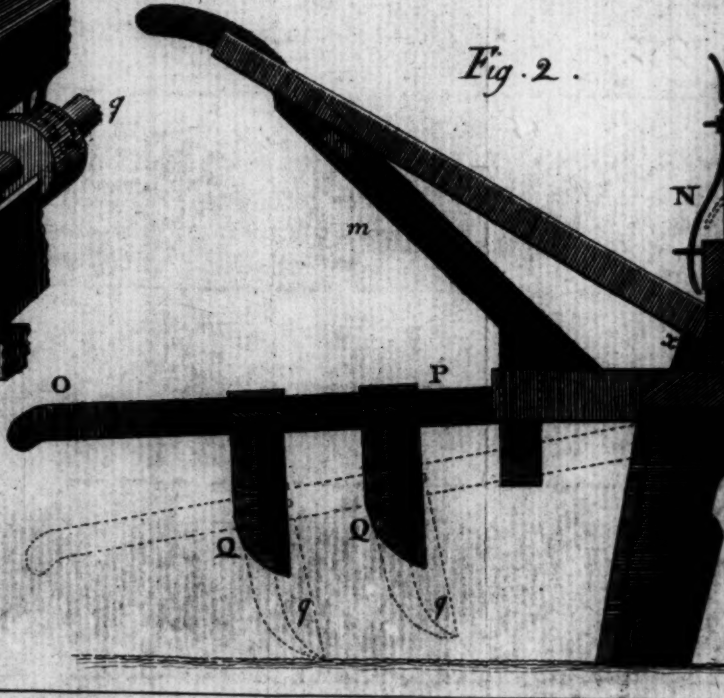


Fig. 2.



Plate

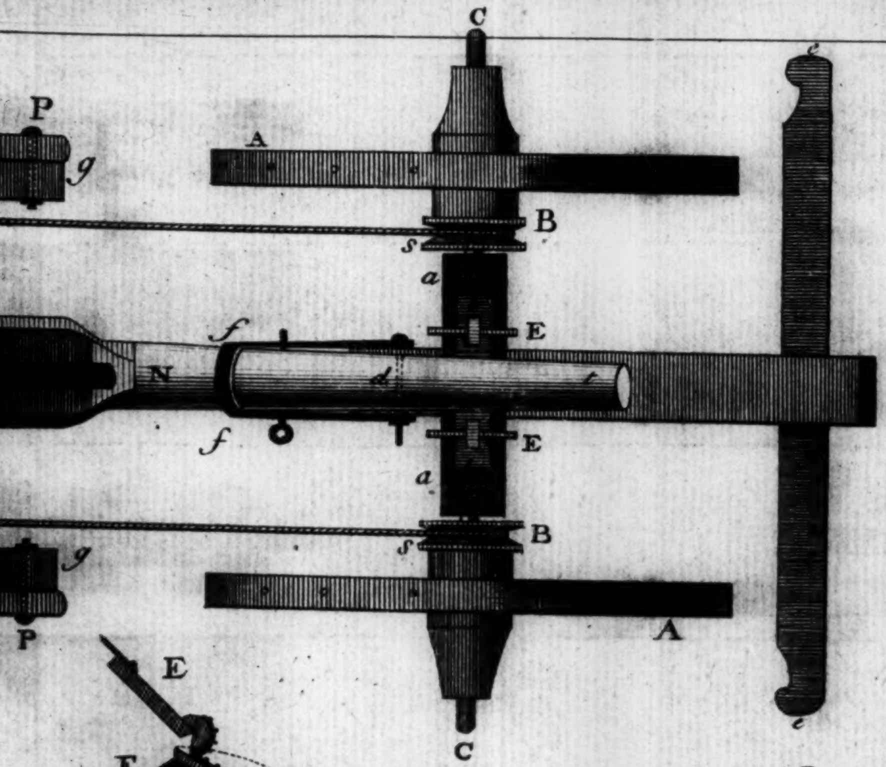


Fig. 4.

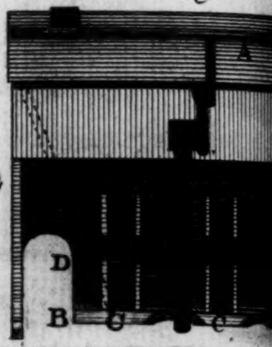


Fig. 5.

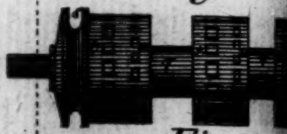
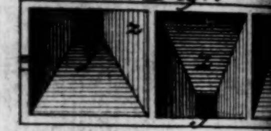
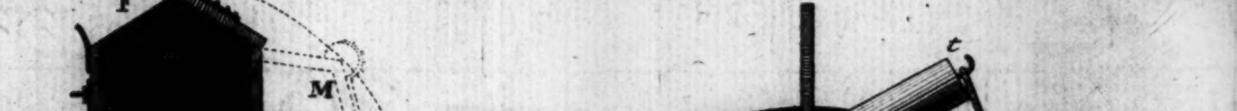


Fig. 6.





Scale of 3 feet

1 2

12 Inches

may be diſtributed: for experience ſhews, that the more this box is inclined, the leſs ſeed drops from it.

O P, *Fig.* 2, is a harrow which ſerves to cover the ſeed, when its teeth *Q Q* drag upon the ground as is indicated by the pricked lines *q q*. When the ſeeds-man would remove the hind-carriage of the drill from one place to another, it is eaſier for him to lift it up by the ends *O*, than by the handles *m*; for the harrow turns upon the bolts *P P*, *Fig.* 1, and is ſubjected by the brackets *V V*, which are at the hinder part of the beams *g g*.

The hoppers *z*, *Fig.* 6, are not faſtened to the table, but are only placed upon it between two grooves, by means of which they can eaſily be ſhoved forward, with the cylinder, its pullies, and the ſeed-box. This is done in a moment, by puſhing the bar *S R*, *Fig.* 1, of which the end *R* is faſtened to the board which bears the hoppers. When the ſeed-box is thus puſhed forward, the cords are looſened ſufficiently for the hind-carriage to be drawn by the collar *f*, and as the cylinder then ceaſes to turn, no more ſeed can be dropped. By drawing back the bar *S R*, the cords are ſtretched again, the pullies are turned as before, and the ſowing begins anew.

M. Duhamel adds here, that though this drill-plough may enable the huſbandman to ſave a great deal of ſeed, yet he muſt not think of uſing it in rocky or very ſtony land, or in a ſtrong clayey ſoil which forms great clods: that it is fit only for ground plowed flat, or in broad-lands; and that no drill will do on land plowed in ridges, for which it will be better to uſe ſome other ſmall inſtrument, ſo conſtructed as nearly to anſwer the ſame end, and which may be faſtened to a common plough, ſo as to make the furrow and ſow at the ſame time.

SOME gentlemen having complained of my not adding Mr. Tull's drills to the many uſeful inſtruments of Huſbandry already given in this work; I beg leave here to obſerve, that the very great length of Mr. Tull's deſcription was a conſiderable objection with me; and that, as his book is in the hands of all our ingenious farmers, I ſhould only have ſwelled this volume with a needleſs and tedious repetition of what they have. — M. Duhamel and all the foreign writers complain, and I believe their opinion will be aſſented to by every one who has not ſeen Mr. Tull's drill, that his deſcription of it is far from conveying clear ideas to thoſe who have not the inſtrument actually before them, or who have not previouſly examined and ſtudied it, even practically.—But what has weighed, and, I confeſs, ſtill weighs with me, more than all the reſt, is the univerſally acknowledged perfection of M. de Chateauvieux's drill-plough, which I think, is neither more intricate, nor, perhaps, more expenſive, than Mr. Tull's, and which is not yet ſufficiently known in this country.

OF HORSE-HOES.

The deſign of ſtirring the alleys or intermediate ſpaces between the beds, has been ſo fully explained in the beginning of this chapter, that it would be needleſs to enlarge upon the ſubject here. — The Rotherham, or Patent Plough, will anſwer all the purpoſes of the firſt and ſecond hoeings extremely well, by means of its bridle *, which enables the plowman to direct this inſtrument very exactly, either as to depth or ſhallowneſs, or to its diſtance from the rows of corn, pulſe, or other plants, cultivated in this manner. I ſhall therefore paſs over what

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* *See* Vol. I. *p.* 256, *and* PL. IV.

M. Duhamel calls his light-ploughs, intended for that purpoſe, and give M. de Chateauvieux's deſcription of his *Cultivators*, which will be found to be of ſignal ſervice, particularly in the laſt hoeings, when the plants will no longer afford admittance to a plough.

Deſcriptiom of M. de Chateauvieux's *SINGLE CULTIVATOR.*

M. DE CHATEAUVIEUX, after remarking the good effects of his plough † in ſtirring the alleys between the rows of corn, rightly judged that the inſtrument now going to be deſcribed, which is much lighter and more ſimple in its make, would anſwer the ſame end; or at leaſt that it might be uſed alternately with that plough, employing this laſt only when a greater quantity of earth is to be turned up towards the rows of corn:" for, ſays he, [a] it is to be obſerved, that the *cultivator* hardly changes the ſituation of the earth, but divides and breaks it in the place it is in, ſo as to render it looſe and light, and fit for the roots of plants to penetrate with eaſe. This inſtrument, like a miner, works chiefly under ground, where it cuts the earth, divides its particles, raiſes it up and lightens it. It has this farther advantage, that one horſe is ſufficient to draw it. The cultivator, *Plate* VII. is compoſed of a beam *A B*, *Fig.* 1, the handles *C D*, and the ſhare *E F*, which is more particularly repreſented in *Fig.* 2, 3, 4, 5, and 6.

" The beam *AB* is three feet and a half, or four feet long. It's diameter ought not to exceed three inches at moſt; and, if it be ſquare, the edges ſhould be rounded off. It ſhould be pierced with mortiſes under the letters *G*, *H*, in order to let through the croſs-ſtaves *I*, *L*; in the ſame manner as in the fore-carriage of the plough; and is fixed by the keys *K*, *M*, or the pins *a*, *b*. The middle of the handles ſhould be exactly oppoſite to the beam; that is to ſay, the ſpace between them ſhould be equal on both ſides. Theſe handles ſhould be made ſlighter than thoſe of the plough before referred to, and they ſhould be fixed to the beam by a tenon in a mortiſe, rivetted at *N*, and ſupported behind by the prop *P*.

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† *Deſcribed in Vol.* I. *p.* 258—265, *and in the ſecond Pl.* IV. *Fig.* 1, 2, *and* 3, *of that Volume.*

[a] DUHAMEL, *Culture de Terres, Tom.* II. *p.* 409. 2*e. Edit.*

" The end *A* of the ſhare, *Fig*. 3, and the two fins *B*, *C*, are made flat. The crooked handle *A B C*, *Fig*. 4, ſhould be triangular, and ſomewhat ſharp before, to anſwer the end of a coulter, as in *Fig*. 2 and 5.

" This ſhare is to be let into a grove cut in the under part of the beam, as repreſented in *Fig*. 7 and 8; and faſtened there by a ſingle ferrule, as in *Fig*. 9. If it ſhould cut too deep, that may be remedied by altering the poſition of the wheel, as in the plough, or by inſerting a very ſmall wedge *g*, *Fig*. 10, between the handle of the ſhare and the beam. If it does not cut deep enough, that wedge muſt be inſerted, as at *h*, *Fig*. 11, at the other end of the handle.

" When this inſtrument is uſed, the beam before deſcribed is to be ſubſtituted in the place of that of the plough, which is to be taken off. The two croſs-ſtaves *I*, *L*, *Fig*. 1, of the fore-carriage of the plough, are then run through the mortiſes *G*, *H*, of this beam, which is thereby fixed to that fore-carriage.

" This cultivator is very eaſily guided: the plowman may hold it upright, or incline it to the right or left, juſt as the intended plowing may require.

quire. The ſhare and it's handle enter ſo deep into the earth, as to be quite buried in it, if a deep plowing is intended to be given: and in that caſe the tail *A* of the beam touches the ground. Tho' the ſhare is but ſmall, it ſtirs the earth at leaſt a foot around it: it's point ſhould be of ſteel, and ſomewhat inclined towards the earth.

"The ſhare of this inſtrument, like that of the plough, may be brought as near as one pleaſes to the rows of corn, by placing the beam accordingly in the frame."

SECT. III.

Deſcription of M. de Chateauvieux's

DOUBLE CULTIVATOR.

"THIS inſtrument, Pl. VII, *Fig.* 12, 13, and 14, has two ſhares. It has a beam *AB*, and the ſhares *CD*, *EF*, *Fig.* 13, which being exactly like that of the ſingle cultivator, I have only to point out wherein theſe inſtruments differ. The beam of this ſhould be ten or twelve inches longer than that of the other. It has likewiſe two mortiſes more, under the letters *G* and *H*, to let through the croſs ſtaves *EK*, *IL*, which bear the handles *MN*, *OP* of the ſhares. The croſs ſtaves *EK*, *IL*, are rivetted permanently to the beam: the handles *MN*, *OP*, are moveable upon the croſs ſtaves, to which they are faſtened by the keys *R*, *S*, *Q*, *T*; ſo that the ſhares may be ſet at a greater or leſs diſtance from each other, according as the quality or ſituation of the ground may require or allow.

"This inſtrument ſtirs the earth extremely well, and does a great deal of work in a little time. Each ſhare being about fifteen inches wide at *AC*, *BD*, *Fig.* 14, and the diſtance between them from *A* to *B*, *Fig.* 14, being about four inches, or, upon occaſion, ſix; and the earth being ſtirred about two inches on each ſide beyond the extent of the outmoſt fins of the ſhares; each cut of this cultivator ſtirs about two feet breadth of ground. This double cultivator requires two horſes, unleſs the ſoil be very light; in which caſe, I fancy one may do, tho' I have not yet tried it.

" If one had a mind to fix a coulter in the middle of the beam, juſt before the ſhares, I ſee no inconveniency that could ariſe from thence, provided it be a very light one.

" The way to uſe this cultivator, is, to faſten it to the fore-carriage of the plough, by running the two croſs ſtaves *V*, *X*, *Fig.* 13, through the beam *A*, *B*.

" I would particularly recommend, not to make the wood-work of this cultivator too thick or heavy, and therefore by no means to exceed the dimenſions I have given: for the lighter theſe inſtruments are, the more eaſily they are managed both by men and cattle."

Deſcription of M. de Chateauvieux's

CULTIVATOR WITH TWO MOULD-BOARDS.

" IF, ſays M. de Chateauvieux,[b] I could have imagined, that my propoſing for the uſe of the new huſbandry, ſome other inſtruments beſides the plough, properly called, could have been looked upon as either ſo expenſive or ſo troubleſome as to diſcourage people from practiſing that huſbandry; I ſhould not, by any means, have thought of communicating them to the public.

" But why ſhould not agriculture enjoy the ſame advantages as almoſt all great manufactories, in which every uſeful diſcovery and improvement, either to perfect the manufacture, or to fabricate it in leſs time and with leſs expence, is readily adopted?

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[b] Duhamel, *Culture des Terres*, *Tom.* IV. *p.* 469, *2e Edit.*

"It is with a view to facilitate the various labours of cultivation, to execute them better, more ſpeedily, and with much leſs expence, that I have introduced the uſe of my new inſtruments in the culture of my own lands. If others think proper to do ſo too, they will enjoy the ſame advantages. I offer them, not as things abſolutely neceſſary, for the plough alone may ſuffice; but as things of which I have experienced the good effects during the years 1753 and 1754; and which, for that reaſon, I think it incumbent on me to recommend to thoſe who adopt the new huſbandry.

"The cultivator with two mould-boards differs from the ſingle cultivator before deſcribed *, only in the two mould-boards which I have added to it, one on each ſide, and which are repreſented in *Plate* VII, *Fig*. 15. *A*, *C*, *E*, *H*, is the mould-board on the left hand ſide of the plough; and *B*, *D*, *G*, *H*, the mould-board on the right hand ſide. The whole of this *Fig*. 15, repreſents an entire and a perſpective view of the ſhare and mould-boards.

"The mould-boards are made of plates of iron, either caſt or hammered, about the twelfth part of an inch thick; which is ſufficient to reſiſt the preſſure of the earth. Thicker plates than theſe would render the ſhare too heavy, and it would be much more difficult to give them their proper bent.

"The two mould-boards join to the handle at *H L*, and lap about an inch one over the other; or elſe they are faſtened together by rivets. They form, in that part, an angle *E*, *H*, *F*, of ſomewhat leſs than ninety degrees, which is ſufficiently acute to ſerve inſtead of a coulter: though a coulter may alſo be uſed upon occaſion, by placing it a little more forward.

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* p.

" From the lower part *L* of the handle, the mould-board ſhould paſs underneath the fin *L*, *G*, of the ſingle ſhare, and follow the direction of that fin, as at *G*; being let in beneath, about an inch and an half, according to the pointed line *L G*, and firmly riveted by three ſtrong rivets.

" The hind part of the mould-boards is fixed and ſupported by the ſtay *F*, to which they are ſtrongly riveted. This ſtay muſt have exactly the ſame bend as the mould-board.

" Behind the lower part of the handle is another ſtay, *M*, *N*, quite cloſe to it, and about two inches below the top of the mould-boards, to which it is riveted at both ends. This ſtay helps to keep them firm: but its chief uſe is to prevent their being raiſed up by the preſſure of the earth againſt their extremities *A* and *B*, which would throw their common angle *H* too forward, and miſplace the ſhare.

" The proper ſlope of the mould boards cannot be ſo well deſcribed by words, as it may be conceived by the figure, which repreſents at *F* the convex inſide of the one, and at *Q* the concave outſide of the other. The diſtance to which the earth is turned over, when the cultivator opens it in order to make a large furrow, depends on the degree of this bending, and the ſpace between the two upper extremities of the mould-boards *E*, *F*.

" The hindmoſt part of the mould-boards is cut ſloping at *C* and *D*, almoſt in a ſegment of a circle. This ſhape helps to effect a greater diviſion of the earth.

" The plate of iron, before it is bent, ſhould be cut nearly in the ſhape of *Fig.* 16.

" The ſize of the mould-boards, as well as their proper bending, depends a little upon the quality the land intended to be cultivated. I have found that, for light ſoils, they need not be bent quite ſo much: ſo that the diſtacce from *C* to *D*, *Fig.* 15, may be twelve or thirteen, and even fifteen or ſixteen inches. This ſame cultivator may likewiſe be uſed in ſtiff lands.

" Nothing hinders making theſe mould-boards two or three inches longer, from *B* to *G*, and from *E* to *H*; or varying ſome of their proportions, as the huſbandman may think beſt.

" This ſhare, with the mould-boards, is fixed to a beam, as in the ſingle cultivator *Fig.* 1, where it is faſtened to the fore-carriage by the croſs ſtaves *I*, *L*.

" If this deſcription does but convey a ſufficiently clear idea of the ſhape and proportions of this cultivator, I will anſwer for its ſucceſs when uſed. I deſcribe it after one of the ſame kind, which I have made uſe of for two years paſt, with very great ſucceſs."

Directions for uſing the

CULTIVATOR WTIH TWO MOULD-BOARDS.

By M. de Chateauvieux.

" This cultivator opens the main furrow in the middle of the alley, by turning the earth over on both ſides at the ſame time; and I have found by experience, that as much work is done by that means, by one turn of this inſtrument, as could be done by two, and frequently three turns of the common plough, and that without uſing a greater number of cattle. I muſt now prove this propoſition; tho' I am perſuaded that it will eaſily be allowed by whoever only caſts an eye upon *Fig.* 15, *Plate*

Plate VII, which repreſents the ſhare of this cultivator.

"The vacant ſpace between the outmoſt row of corn on one bed, and the neareſt row to it on the next parallel bed, which is what I call the alley, and which is not ſown at all, is the part that is to be cultivated at different times, from the firſt ſprouting of the corn, till it is ripe.

"The practice of the new huſbandry has already ſhewn ſufficiently, that too narrow alleys would ſcarcely anſwer any of the ends they are intended for; and that making them too wide, is a loſs of ground. About four feet, excluſive of the ſpaces or partitions between the rows of corn in the beds, is a good middling breadth.

"It is leſs neceſſary to make the alleys quite ſo wide in good ſoils: nor indeed do I think four feet ſo abſolutely neceſſary at any time, but that a few inches leſs may do. An intelligent huſbandman will eaſily judge what is moſt proper to be done in this reſpect. But what greatly merits the attention of every one, and ought never to be loſt ſight of, is, that wide alleys are more eaſily and much better ſtirred than thoſe which are narrower: for when an alley is wide, the great furrow in the middle of it may be cut deep, there being then ſufficient room to turn the earth over towards the rows; whilſt, on the other hand, in too narrow alleys, the earth cannot be ſtirred deep enough, nor can room be found for what is turned over out of the furrows, without danger of burying great part of the rows.

"I therefore ſuppoſe the general breadth of the alleys to be about four feet. But the whole of that breadth is not to be plowed or ſtirred, either with the plough or cultivator, as ſoon as the field is ſown. Neither of theſe inſtruments ought to go too near the rows of corn, for fear of rooting up the plants: but a ſlip of earth, about ſix inches wide, ſhould be left untouched on the outſide of each bed; by which means the part of the alley that is to be ſtirred, will be reduced to the breadth of three feet; and even that is leſſened in the firſt plowing before winter, by a deep furrow which is then cut cloſe to and all along thoſe ſix inch ſlips, and the earth taken out of that furrow, or thoſe furrows, is thrown into the great furrow in the middle of the alley, which it ſerves to fill and arch up. Theſe two ſide furrows make together a breadth of about eighteen inches, and conſequently leave in the middle of the alley a breadth of about eighteen inches more, on which is heaped up the earth thrown out of the two furrows: and thus the alleys remain all the winter.

" The firſt hoeing in the ſpring ſhould turn the earth heaped up in the middle of the alleys, back towards the rows of corn. The two furrows that were opened before winter, are then filled up, and a new one is cut in the middle of the alley.

" To perform this firſt hoeing with the common plough, which may very eaſily be done, two turns of that inſtrument will neceſſarily be requiſite, *viz.* one on each ſide of the alley, as near as poſſible to the beds. But as even with thoſe two turns, the furrow will frequently not be well formed, but a great deal of earth will ſtill remain between it and the bed, a third turn of the plough is often neceſſary, and ſometimes a fourth, to hollow the middle furrow as it ought to be.

" To perform this work with the cultivator with two mould-boards, that inſtrument muſt be placed in the middle of the alley, and the horſes in one of the two furrows. The ſhare will eaſily enter, and that to a great depth, into the earth which was laid there by the laſt hoeing before winter: and as the horſes advance, that great ridge of earth will be divided into two parts, which will be turned over into, and will fill up, the furrows that were made before winter on each ſide of the alley, cloſe to the beds. Thus, the great furrow in the middle of the alley will be opened, and the whole operation performed by one turn of the cultivator. The earth thus turned over will be thoroughly ſtirred, and ſo much time and labour will be ſaved by this method, that the farmer may eaſily afford one or two ſtirrings more in the ſummer, which will always be of great ſervice.

" I have found ſo much benefit from making the furrow in the middle of the alley very deep, that I have ſometimes given it a ſecond plowing with the cultivator with two mould-boards, eight or ten days after the firſt; by which means I have cut it ſo deep that I have been ſure of having a depth of fifteen or eighteen inches of well looſened mould under the middle of my next year's beds.

" My lands have been brought to ſo fine a tilth by the plowings of former years, that I have not had any occaſion for a coulter to my cultivators: however, it may be proper to uſe one where the ground has not been ſufficiently looſened by the preceding culture.

" To ſhew to what degree of pulveriſation my lands have been brought, and how extremely light they now are, I ſhall only mention the following fact. I uſed but one and the ſame cultivator with two mould-boards during the whole courſe of the years 1753 and 1754, and never had occaſion even once to have the ſhare new pointed. The friction and reſiſtance of the earth were ſo little in my grounds, that the point of my ſhare was not worn at all, whilſt, in the ſame years, my neighbours were obliged to have the ſhares of their common ploughs new pointed almoſt every day.

Deſcription

Deſcription of a Cultivator invented by

M. DE VILLIERS.[b]

" THIS inſtrument is compoſed of a ſhare, *Plate* VII, *Fig.* 17, the two fins of which are eight inches and a half aſunder at their extremities *a*, *b*. The ſocket *c*, which is between the two fins, projects ſome inches, and the hollow in it is three inches long, and one inch wide. It does not deſcend ſo low down as the fins, to prevent its touching the earth. The length of this ſhare, from the point *d*, to the extremity of the fins *a* or *b*, is from 12 to 13 inches. At the diſtance of five inches from the point *d*, is a hole *e*, into which is inſerted the crooked point *f*, of the iron ſafeguard, *Fig.* 18, which is uſed in ſome countries in order to faſten the ear to the ſhare of the plough. Upon the ſhare is placed a ſmall triangular ear *b*, *Fig.* 20, 21, and 22; ſomewhat concave at bottom, that the two ſmall ears may join exactly to the ſhare at about an inch diſtance from the edge of the fins. This ear is about two inches and a half high at *a*, *Fig.* 21, and is faſtened firmly to the ſhare by a double and angular ſafeguard, which covers its edge as far as *b*. It is fixed at one end by its point, which enters into the hole *e*, *Fig.* 17, in the ſhare, and by four ſmall pins faſtened to the ear. *Fig.* 18 and 19 repreſent this ſafeguard. The double ear is faſtened at its other extremity, by the ſheat or upright piece *e*, *g*, *Fig.* 21, which paſſes through the ground-reſt of the hinder part of the ear and beam, and by a piece of iron *c d* bent in a right angle. This piece of iron covers the fore part of the ſheat, and reſts upon the tail of the ear, againſt which the beam preſſes it very tight, by means of a wedge *e*, driven into the ſheat. The piece *c d* may likewiſe ſerve to fix two mould-boards from *g* to *c*. It is nine inches high. *f* is another ſheat or upright piece, which joins the beam to the ground-reſt, to add to the ſtrength and ſolidity of the inſtrument, which is increaſed alſo by the lower part of the handles being fixed in the ground-reſt at *i*, and traverſed by the beam at *k*."

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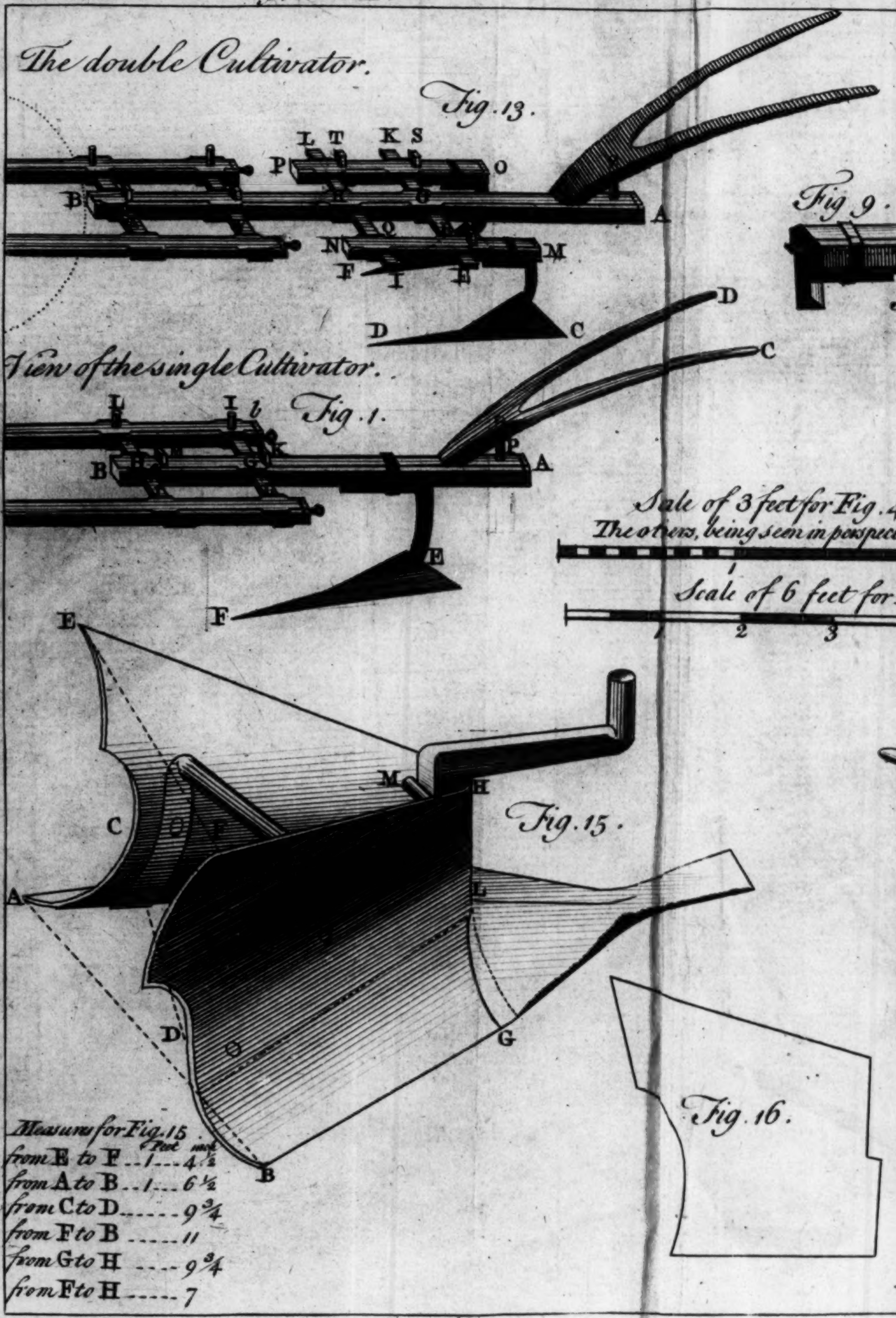
[b] DUHAMEL, *Culture des Terres*, *Tom.* IV. *p.* 76, 2d. *Edit.*

M. de Villiers, in a letter to M. Duhamel gives the following account of his manner of uſing this cultivator.

"Finding it impoſſible to plow my alleys well " when they were but three feet or three feet and " a half wide, without greatly damaging the rows " of corn bordering upon them; I reſolved to " make them four feet wide, and took particular " care to have the rows drilled very ſtrait: but " even then I found only one way of plowing them " well, which is, to open the firſt furrow ſo near " to the bed, that the next furrow within that may " come within two or three inches of the neareſt " row of plants in the bed; turning over the earth " of theſe furrows towards the alley. After two " or three ſuch turns of the plough, the plowman " will be ſure not to make any miſtake. It is of " great importance to cut this firſt furrow, by " which all the others are directed, quite parallel " to the rows. The reſt of the work will then go " on regularly, and without any of that confuſion " which would be capable of giving many people " a diſlike to the new huſbandry. My horſes were " led by hand, till they were ſufficiently accuſtomed to this work: but that was neceſſary only " for the firſt furrow, which they afterwards follow



The double Cultivator.

Fig. 13.

Fig 9.

View of the single Cultivator.

Fig. 1.

Scale of 3 feet for Fig. 4

The others, being seen in perspec

Scale of 6 feet for

Fig. 15.

Fig. 16.

Measures for Fig. 15	Feet	inch
from E to F	1	4½
from A to B	1	6½
from C to D		9¾
from F to B		11
from G to H		9¾
from F to H		7

Fig. 10.

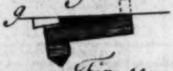


Fig. 11.

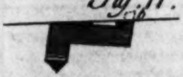


Fig. 7.

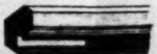


Fig. 8.

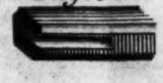
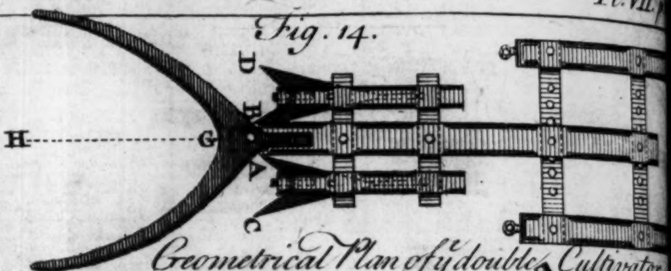


Fig. 14.



Geometrical Plan of ye double Cultivator.

Fig. 9.

Fig. 6.

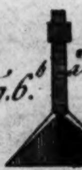


Fig. 5.

Fig. 4.

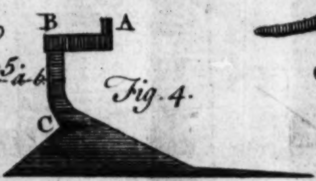


Fig. 3.

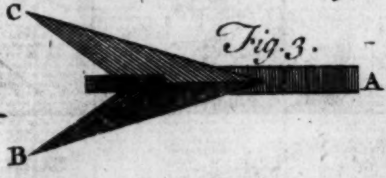


Fig. 2.

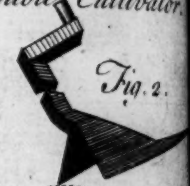
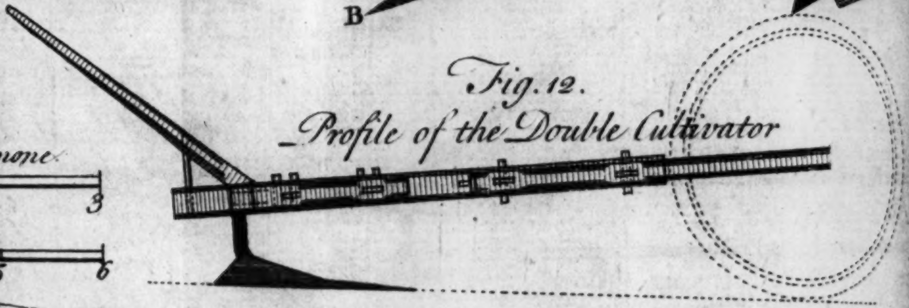


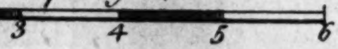
Fig. 12.

_Profile of the Double Cultivator



r Fig. 4.5.6.& 7.
n perspective, require none.

feet for Fig. 14.



Mr. Duhamels Light Plough

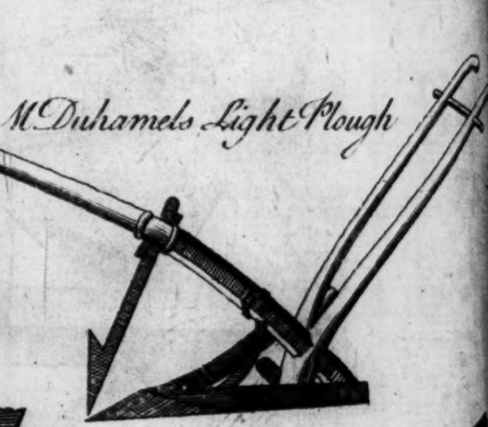


Fig. 17.

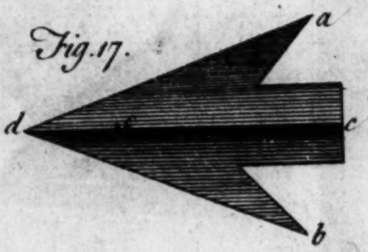


Fig. 22.

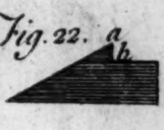


Fig. 21.

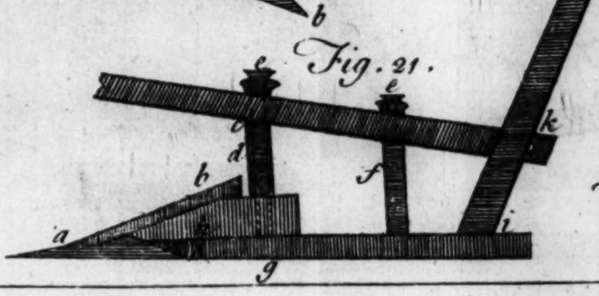
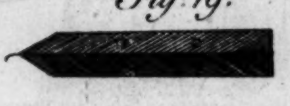


Fig. 19.



"of their own accord, ſo that the reſt of the alley "is plowed with great eaſe:

"The earth of the ſecond furrow, which is cut "very near to the rows, is turned over in the ſame "direction as that of the firſt; that is to ſay, from "the bed.

"The third furrow is plowed the contrary way, "and the earth is then turned over towards the "rows, ſo that the laſt furrow is filled up by this "plowing, and a conſiderable quantity of well "divided earth is turned over to the rows, for "the plants to extend their roots in in the ſpring.

"I then continue plowing in the ſame direction, "cutting the furrow that is turned over towards "the rows as thick as poſſible, till the "whole alley is plowed almoſt cloſe to the oppoſite "bed, when, by turning over one large furrow "on that ſide, the ſmall one cut there at firſt "is filled up. By this means, the firſt ſpring "hoeing is completely executed.

"I begin the ſecond plowing on the ſide where "I ended the firſt, turning the earth over that "way, which is the contrary to what was done "before: and when I come to the other ſide "of the alley, I leave there, as was left before on "the ſide I now begin at, the breadth of a ſmall "furrow, which I do not plow, but over which I "turn the earth of my laſt furrow.

"I think this ſecond hoeing may be deferred, "when the ground does not produce many weeds: "and in this caſe I perform it with the cultivator, "which I bring almoſt cloſe to the rows.

"After thus uſing, ſometimes the plough, and "ſometimes the cultivator, according as the condition "of the ground ſeems to require, I finiſh "all my hoeings by putting two horſes to the "cultivator, and drawing it once or twice through "the middle of the alleys; becauſe it cuts four "or five inches deeper than the plough."

M. de Villiers adds, that he could not always tutn the earth over towards the rows, as M. Duhamel directs, becauſe the wheel of his plough, getting too deep in the middle furrow, altered the direction of the ſhare. To this M. Duhamel obſerves, that he himſelf met with the ſame difficulty, and found no other way of remedying it, but by opening a ſmall furrow near the rows, by the help of which he turned the earth over towards the alleys, and then filled up that furrow immediately; taking care at the ſame time to turn the mould over towards the roots of the plants, ſo as to earth them up as much as poſſible. "I am glad, adds he, "that I have had this opportunity of giving M. "de Villiers's method, becauſe I think it a good "one, and believe it will be of great ſervice to "ſuch as may be inclined to practiſe the new huſ"bandry."

Obſervations on Horſe-hoeing, by M. de Villiers.

"I HAVE tried, ſays this gentleman[c], to hoe "my alleys after M. de Chateauvieux's me"thod, which I look upon as the beſt and moſt "expeditious; notwithſtanding that ſeveral diffi"culties which I have met with in the practice of "it, have obliged me to give it up. For exam"ple, the great furrow in the middle of the alley "is, according to his directions, to be filled up "by two turns of the plough, one on the right "hand, and the other on the left, after which it "is to be opened again by one turn of the culti"vator with two mould-boards, or two or three "turns of the common plough.

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[c] DUHAMEL, *Culture des Terres, Tom.* V. *p.* 133. *2e. Edit.*

"When I ſet about this work, the firſt turn of "the plough, if the ſhare went to any depth "worth ſpeaking of, always filled up the furrow "in ſuch manner, that to prevent it's being "poached by the horſes, I tried to make them "walk on one ſide, upon the upper ground, and "conſequently very near to the rows of corn: "but then, in the firſt place, I could not avoid "the deſtruction of a great number of plants, "without giving ſuch attention as was not only "exceſſively troubleſome, but almoſt impracticable: and ſecondly, I could plow only the ſurface; becauſe, as the furrow was filled, the "plough could turn up but very little earth, "without being choaked, and becoming extremely heavy.

"If, to ſave the plants, I made the horſes "tread partly upon the mould turned over into "the furrow, the plough choaked equally, and "for the ſame reaſon, whenever the furrow was "cut deep. All I could do in this caſe, was "to give only a ſuperficial plowing: and with "that it was impoſſible to uſe the cultivator with "two mould-boards, to form the furrow, becauſe "that inſtrument cannot work in any but a looſe "well-tilled ground.

"All theſe inconveniencies may not happen in "a ſoil different from mine. I am the more inclined to think this, as M. de Chateauvieux "certainly does not experience them: but at the "ſame time I muſt likewiſe obſerve, that this "juſtly celebrated gentleman has inſtruments "ſo perfect, and directs his ſervants with ſuch "ſuperior judgment, that few can expect eaſily "to equal him in the practice of the new huſbandry.

"Not being able, for the above reaſons, to do "with one turn of the cultivator with two mould-

" boards, what, as M. de Chateauvieux himſelf " obſerves, can frequently not be done with leſs " than three or four turns of the common plough, " which, added to the two turns that are given to " fill up the furrow, make in all five or ſix bouts, " I purſued, and with great advantage, nearly the " method before deſcribed. I ſay nearly that method, " becauſe I have made ſome few alterations, " by which I think it is rendered both eaſier and " better.

" 1. I make the mould-board twelve or thirteen " inches deep, inſtead of nine or ten that it was " before. The furrows are by this means made " wider, and the plough is more eaſily drawn, be" cauſe it finds more room to diſcharge its load of " earth in, and ſuffers leſs preſſure.

" 2. To give the ſecond hoeing with the " plough, inſtead of continuing to turn the earth " over towards that ſide of the alley where only " one furrow was turned up at the ending of the " firſt plowing, I, on the contrary, begin this " ſecond at that furrow, approaching, if poſſible, " to within two or three inches of the row of " corn; and then I make a furrow in the contrary " direction, which turns the earth up againſt that " row.

" My reaſon for plowing ſo near the rows, when " I give this ſecond hoeing, is, that I have ob" ſerved that the rains which fall pretty frequently " in the ſpring, between the firſt plowing and the " ſecond, harden the earth greatly, and that " drought afterwards hardens it ſtill more, ſo that " the roots of plants can no longer pierce or ſpread " in it with eaſe: and yet nothing is more neceſ" ſary, in order to their being benefited by every " culture of the earth, than that they ſhould find " an eaſy paſſage into the mould which lies next " to the rows. It is therefore highly proper to ſtir

" that mould, when the ſecond hoeing with the " plough is given, which, with me, is when the " corn has begun to ſpindle; that being the time " when the plants ſhoot with the greateſt vigour, " and when their roots ought conſequently to begin to extend to ſome diſtance.

" I have not perceived that the plants have " been at all damaged by the plough's coming ſo " near them. They ought to be ſo much the leſs " hurt thereby, as the rows are placed over a furrow which has been cut deep; a ſituation which, " alone, is capable of making the corn tiller, and " puſh ſtrongly: though the aſſiſtance of culture " is likewiſe neceſſary, to ſupply the ſtalks and ears " with plentiful nouriſhment.

" I am the better pleaſed with this method of " bringing the hoe-plough almoſt cloſe to the " rows, as it facilitates a very important operation " ſtrongly recommended by M. Duhamel, and " which I never before thought practicable: I mean, " the raiſing up of the earth about the bottom " of the plants; as well to give them greater nouriſhment, as to prevent their being lodged. " The following is my method on this occaſion.

" When I fill up the furrow which I have cut " as cloſe as poſſible to the row, I hold the plough " ſloping, in ſuch manner that the earth is forced " away from it, and is raiſed up about the plants. " If this ſlope is not ſufficient, which may ſometimes depend on the condition of the ground, or " the dexterity of the plowman, I, in that caſe, " make the mould-board two or three inches wider, when I uſe it to fill the furrow, than it was " when I made that furrow: and to this end I " ſcrew on to the extremity of the mould-board, " a thin plate of iron about four or five inches

" wide. Thoſe who practiſe the new huſbandry " in ſo extenſive a manner as to employ ſeveral " ploughs, will find no inconvenience in having " one, larger than the reſt, purpoſely for this important operation. As I do not give this ſecond " hoeing with the plough, till after the corn has " begun to ſpindle, it is eaſy for me to avoid burying the plants, eſpecially if there are no great " clods in the ground: but, at all events, I always earth the plants up as much as poſſible, " when there is no other danger than that of burying here and there a few of them, becauſe that " accident is eaſily remedied afterwards, if it be " worth while.

" When I am to give the third hoeing with " the plough, I conſider the condition of the " ground. If it is in good tilth, well looſened, " and free from weeds, I uſe only the cultivator: " otherwiſe I uſe the plough, three or four turns " of which are ſufficient to perform this operation, " in the following manner.

" The firſt cut turns the earth over into the " middle furrow: the ſecond and third are in a " contrary direction; and the fourth takes up what " was looſened by the third, whereby the furrow " is replaced in the middle of the alley. Some " time after this, and eſpecially if a ſhower of " rain has fallen, I cut that furrow ſtill deeper, " by one turn of the ſingle or double cultivator, " as M. de Chateauvieux directs.

" But as, even after all theſe plowings, the " great furrow may chance to be neither deep " enough, nor ſufficiently cleared of mould, owing either to the imperfection of the inſtruments " made uſe of, or to the inaptitude of the plowman, that defect may eaſily be remedied after " harveſt, by giving one plowing more, which is

" to be begun by throwing up the earth to the " right and left, towards the ſummit of the beds; " that is to ſay, over the ſtubble. This practice " is alſo confirmed by M. de Chateauvieux's in- " ſtructions.

" The one plowing extraordinary which this " operation requires, ought not to be thought " much of; becauſe the moſt important point in " the new huſbandry certainly is, the providing " of a good depth of well ſtirred mould, for the " plants to extend their roots in."

ARTICLE III.

EXPERIMENTS *on the Culture of* Grain and Pulſe *in the Horſe-hoeing Huſbandry; with a Compariſon of it and the old Methods.*

HAVING now deſcribed every kind of inſtrument either peculiar to, or neceſſary in the horſe-hoeing Huſbandry, but which may be altered or varied by the ingenious and experienced Farmer; I ſhall proceed to Experiments, in order to elucidate and confirm the principles before laid down: — and here, as Mr. Tull himſelf might be thought a prejudiced evidence in behalf of his favourite opinion, I ſhall collect my teſtimonies from the beſt authorities I can find elſewhere. — Mr. Philip Miller is a very warm advocate for the Horſe-hoeing Huſbandry; and I am ſorry to ſay, that none elſe has yet appeared in our language.

M. Duhamel's other great employments hindered him from attending perſonally to the experiments made on this ſubject, by his direction; and the ſame, unfortunately, happened to ſeveral of his correſpondents. I ſhall therefore dwell moſt particularly on thoſe which were made under the immediate inſpection of the gentlemen who mention them; among which number no one has extended his views to a greater variety of objects, executed his experiments with greater accuracy, related them with more candour, or drawn from them more ſenſible reflections, than M. de Chateauvieux, who, for theſe reaſons, will here be my chief guide: and, as he has all along made exact compariſons, not only between the old Huſbandry and the new; but alſo between ſowing with the drill, and the uſual manner of ſowing, both in the old and the new Huſbandry; I ſhall unite from him the Experiments and the Compariſon. — The ſubject will be reſumed when I come to treat of the culture of Pot-herbs in the horſe-hoeing way; becauſe the judicious change of crops will there throw a conſiderable light upon it.

After M. de Chateauvieux's Experiments, I ſhall ſingle out, from thoſe made by M. Duhamel's other correſpondents, ſuch as are moſt concluſive, and contain a variety which may be uſeful to the public.

" The horſe-hoeing huſbandry, ſays Mr. Miller[a], which was practiſed by Mr. Tull, has been almoſt univerſally rejected by the farmers in every country; it being ſo oppoſite to their accuſtomed practice, that they cannot be prevailed upon to make a trial of it: and indeed ſome abſurdities in Mr. Tull himſelf have greatly contributed to diſguſt them; one of which, and that perhaps not the leaſt, is, his poſitively aſſerting, that the ſame land would nouriſh the ſame ſpecies of plants, without changing the crops, for ever, and this without manure; which his own experience afterwards proved to be falſe. — But, notwithſtanding theſe and ſome other particulars which have been advanced by Mr. Tull, it is much to be wiſhed, that this new huſbandry might be univerſally practiſed; for ſome few perſons who have made ſufficient trial of it, have found their crops anſwer much better, than in the common or old method of huſbandry. — Even if the produce of land in the new huſbandry does not exceed that in the old way; yet, by ſaving ſeven parts in eight of the ſeed-corn, it is a great affair to a whole kingdom; eſpecially in times of ſcarcity.

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[a] *Gardener's Dict.* Art. TRITICUM.

" I ſhall only mention two or three late experiments which have been made in the new way, whereby it's utility will more fully appear.

" The firſt was in a field of wheat, which was ſown partly in broad-caſt in the common method, and partly according to Mr. Tull's method. The ſpots thus ſown were not regular in lands, but interſperſed indifferently in many directions. Thoſe parts of the field in Tull's method were in rows at two feet diſtance, and ſtood thin in the rows. The roots of the wheat in thoſe ſpots had from ten to thirty ſtalks upon a root, and continued upright till it was reaped; whereas few of the roots in the common method had more than two or three ſtalks, and theſe were moſt of them lodged before harveſt: ſo that, upon trial of the grain when threſhed, there was near a third part more in weight and meaſure than from the ſame extent of ground, taken in the beſt part of the field ſown in the common way.

" Another trial was made by ſowing of the corn in rows at different diſtances, with ſome ſown in two parts of the ground broad-caſt. The event was, that all which was ſown broad-caſt, in the uſual way, was lodged, as was alſo moſt of that where the rows were ſix or nine inches aſunder: that which ſtood a foot diſtance eſcaped better, but the rows two feet aſunder were the beſt, and the produce much greater than any of the other. This plainly ſhews the abſurdity of the practice of ſowing a great quantity of ſeeds, to have a better produce, which is the opinion of moſt of the old farmers.

"The produce of an acre of wheat is various; according to the goodneſs of the ſoil. In ſome of the ſhallow, chalky, down-lands, where near four buſhels of corn have been ſown, I have known the produce not more than double of the ſeed: but when this is the caſe, the farmer had much better let his land lie waſte, ſince the produce will not defray the expence; ſo that more than the rent of the land is loſt. Though theſe ſorts of crops are frequently ſeen on ſuch land, yet the paſſion for plowing is ſo ſtrong among our huſbandmen at preſent, that, if they were not reſtrained by their landlords, they would introduce the plough into every field, notwithſtanding they are ſure to loſe by it.

"But, although the produce of theſe poor downs is ſo ſmall, yet, upon good land, where the corn has ſtood thin upon the ground, I have known eight or ten quarters reaped from an acre, over the whole field, and ſometimes more: and I have been informed by perſons of credit, that on good land, which was drilled and managed with the horſe-hoe, they had twelve quarters from an acre of land, which is a great produce: and this with greater certainty, if the ſeaſons prove bad, than can be expected by the common huſbandry."

Thus far Mr. Miller, whoſe remarks ſhould have their proper weight.

I have frequently quoted M. de Chateauvieux in the former Volume of this work, as the moſt indiſputable authority for what was then ſaid: but as his Experiments will appear cleareſt and moſt concluſive when related in his own words, and in an uninterrupted ſeries, I ſhall give them here at full length, without ſcrupling to repeat what may have been mentioned before; eſpecially as thoſe very points will acquire double ſtrength, when the reader compares them with the following narrative.

Experiments made in the year 1751, by

M. LULLIN DE CHATEAUVIEUX,

Firſt Syndic of the City and Republic of Geneva.

"IN October 1750, ſays M. de Chateauvieux[b], I began my Experiments on a ſpot of ground, of a rich ſtrong ſoil, one hundred and ſixty feet long and forty-two feet wide. Not being then provided with proper inſtruments for the horſe-hoeing huſbandry, I ordered it to be dug with the ſpade, and laid it out in ſeven beds of equal ſize. Great care was taken to break the clods thoroughly, and to dig the earth very deep. The beds, which were in a looſe ſtate, were raiſed high in the middle.

"On the fourteenth of October, I ſowed three of theſe beds with wheat, two with barley, and two with oats. I muſt obſerve that, in this country, it would have been better to have ſowed a fortnight earlier.

"I made three furrows in each bed, ſo ſhallow, that the ſeed was not buried above half an inch deep. The wheat was dropped by hand, in ſingle grains, at the diſtance of ſix inches from each other. The barley was dropped at the diſtance of nine inches, becauſe it branches more than wheat.

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[b] **DUHAMEL**, *Culture des Terres, Tom.* II. *c.* 1.

Though oats branch more than either, yet, as they are a tender plant, and apt to be killed by the winter's cold, I ſowed them at the diſtance of three inches one grain from another.

" I uſed 2880 grains of wheat, weighing three ounces fifteen penny-weights, to ſow the three beds. In one of the beds of barley I ſowed four rows. I employed 1491 grains, weighing two ounces, in the ſowing of two beds; and four ounces of oats were ſufficient to ſow the two other beds. I neglected to count the grains of the oats.

" Theſe ſeeds came up very well, and though they grew but little before winter, yet ſome of them put forth their ſecond blade. They ſoon ſuſtained a conſiderable loſs. Numbers of ſmall ſnails eat many of the plants cloſe to the earth. I judged it neceſſary to ſupply this loſs by ſowing freſh ſeed.

" The winter wrs very unfavourable to corn. We had almoſt continual rains, with little ſnow or froſt. The corn in general ſuffered greatly, and the crops were very inconſiderable in this country.

" Early in the ſpring, theſe plants made ſtrong ſhoots, and had much the better of the corn in the common way. Their blades were very large, and of a deep green, and the number of ſtalks increaſed greatly. The alleys were hoed in good time, and the advantage reſulting from this operation was very manifeſt. I viſited my plants towards the latter end of April, and found their numbers greatly diminiſhed. The miſchief which the ſnails had done them was almoſt the only cauſe. The inclemency of the winter likewiſe deſtroyed ſome: ſo that I found I had loſt 1068 plants of wheat, and had but 1812 remaining. My plants of barley fell ſhort by 412, their number being reduced to 1079. The winter deſtroyed ſo many plants of the oats, that very few were left.

"From this time, all the plants grew exceedingly: they branched ſo much, that, as far as I could judge, every plant of wheat, taking them one with another, produced twenty-eight ſtalks, the barley above forty, and the oats ſtill more. Each plant formed a large tuft, ſome of ſixty, eighty, and above a third part of the plants of about 150 ſtalks: ſo that, though they were at firſt at a great diſtance from each other, in June and July they entirely covered the ſurface of the alleys. All theſe ſpindled, and produced, each in its kind, very long and large ears, full of grain from end to end. They ripened kindly, but had not yet got over all their miſchances. Theſe fine ears became a prey to birds, which could not be kept off. This is an inconvenience to which all ſmall experiments are liable. That I might ſave ſomething, I was obliged to cut my corn down before it was quite ripe. But before I did that, I examined perſonally, with all poſſible care, what might be the amount of the loſs which I had ſuſtained by the birds: and beſides this, I ſent for four farmers, in quality of appraiſers, to eſtimate the damage. They all agreed, that it was above half the crop, and aſſured me I ſhould not miſtake if I reckoned it as ſuch. I had formed the ſame judgment myſelf. We found the loſs ſomewhat leſs conſiderable in the barley. As to the oats, it could not be ſo well aſcertained; but we believed it could not be leſs than a third part of the crop.

"While the wheat ripened, I diſcovered that ſome of the plants were blighted. All theſe, whether blighted totally or only in part, were plucked up by my direction, before I cut down the reſt of the crop. They amounted to 297; ſo that I was reduced to 1515 plants of wheat, the ſeed of which, after deducting that which produced the 297 blighted plants, is reduced to two ounces and ſix penny weights. The 1515 plants were the whole produce of the crop, and theſe yielded 55 pounds of eighteen ounces to the pound. But the ſame ground and plants produced likewiſe what was eaten by the birds; for which it is but juſt to make an allowance. The whole produce will then have been in reality 110 pounds, which to me ſeemed very conſiderable.

" I made another enquiry, which I judged to be of ſome importance: this was, to know whether the number of the fineſt and largeſt ears, was greater than that of the middling and ſmalleſt. I examined them with the utmoſt attention, and found almoſt all the ears of equal beauty; at leaſt nineteen out of twenty, I am confident, were ſo.

" I was likewiſe willing to know what number of grains might be contained in each ear. To this end, without regarding the proportion I had found between the number of the fineſt ears and that of the ſmalleſt, I took twelve middle ſized ears, twelve of the ſmalleſt, and twelve of the fineſt.

" The twelve middling ears contained one with another thirty-ſeven grains;

" The twelve ſmalleſt ears, thirty grains; and

" The twelve fineſt ears, fifty grains apiece.

" The 1079 plants of barley, produced ſeventy-five pounds of eighteen ounces to the pound. What was eaten by the birds ſhould likewiſe be added here.

" My oats produced one hundred and three pounds of eighteen ounces, excluſive of what was deſtroyed by the birds.

" This little experiment ſhews, that the new huſbandry will be equally profitable for all ſorts of grain.

OBSER-

OBSERVATIONS *on the foregoing Experiment, by M. DE CHATEAUVIEUX.*

" THE quantity of wheat gathered from the three beds, ſeems to me as great as could be expected. Though I had but fifty-five pounds, yet, adding thereto the fifty-five eaten by the birds, this little ſpot yielded one hundred and ten pounds. In large fields, we are not ſo ſenſible of what the birds deſtroy.

" If we likewiſe take into this account, the 1068 plants deſtroyed by the ſnails, and the 297 blighted plants, making together 1365; theſe would have yielded 100 pounds of wheat, and the whole crop would have been 210 pounds: for it cannot be doubted but they would have yielded in the ſame proportion as the 1515. What proves it is, that in a ſpace about thirty feet long, at the end of the beds, which eſcaped the ſnails, very few plants failed; and the reſt were very thriving and branched greatly: ſo that it is evident, the whole ground could eaſily have nouriſhed all the plants that were intended to grow on it, and which were at the diſtance of ſix inches from each other. I make this remark, in order to ſhew what may be expected from the following experiments; it being an eaſy matter to ſow the ground ſo as to have the deſired number of plants.

" I ſuppoſe then, and I think juſtly, that this ſmall ſpot of ground can produce 210 pounds of wheat at one crop: but the ineſtimable advantage of the new husbandry is, that it keeps the earth in a ſtate fit for ſowing every year; ſo that in two years it can yield 420 pounds; whereas, in the common husbandry of this country *, the farmer can have but one crop in that time, being obliged to ſow his land only every ſecond year; and that one crop will fall greatly ſhort of the two which the new husbandry will produce. A vaſt advantage in favour of this laſt.

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* The neighbourhood of Geneva.

"Without being too partial to the new huſbandry, we may expect that the ſecond and following crops will be more plentiful, the earth being in finer tilth. Accordingly, the wheat with which I have ſowed theſe three beds a ſecond time, is already viſibly benefitted by the looſer ſtate of the mould which was ſo frequently ſtirred in the ſummer. I have provided againſt the accidents which deſtroyed ſo many of my plants, by ſowing thicker. Inſtead of three ounces fifteen penny-weights of wheat, which I ſowed laſt year, I have now ſowed nine ounces and twelve penny-weights; and though the ſnails have again eaten many of the plants this year, cloſe to the ground, a ſufficient number ſtill remains, by means of the additional ſeed, to fill the beds, and they are equally diſtributed.

"I ſhall now compare the crop I have been ſpeaking of, with that of the experiment which I made on the ſame ſpot of ground in the year 1729, in order to ſee whether I could not obtain a more plentiful return, by ſowing thinner than is uſually practiſed. The ground was plowed and ſowed in the common way. I employed ſix pounds of wheat to ſow it, being ſomewhat leſs than half the uſual quantity. The plants looked extremely well during the whole time of their growth, and produced above double the quantity that wheat did in the common fields. They yielded me 105 pounds of wheat. Even in this way, I could have but one crop in two years: and it appears that I have not exaggerated the produce of the new huſbandry, in making it 420 pounds in the ſame ſpace of time, which is a clear gain of 315 pounds.

" I afterwards tried ſome other experiments; one of which, made in the year 1746, I muſt now mention. I tried two things at the ſame time: firſt, whether wheat would grow after it had been kept ſeveral years; and ſecondly, whether ſowing each grain at ſix inches diſtance would turn to account. As I did not intend to make the experiment on a large field, I choſe for it a ſpot of ſtrong earth, in bad condition, fit for making bricks. I ſowed in it three quarters of an ounce of wheat, which I had preſerved carefully for eight years. It roſe pretty well *; but about one fourth of the grains did not ſprout at all. After the winter, theſe plants grew very ſtrong. I delayed ſeeing them too long, for I found them quite choaked with weeds. I ſent a woman to weed them, who, unluckily, at the ſame time pulled up almoſt all the plants of wheat: the fineſt ſuffered moſt, ſhe not imagining that they could be wheat. There were but about forty plants left, and thoſe at very great and unequal diſtances. Theſe produced tufts of upwards of fifty ſtalks, with ears five or ſix inches long, containing a great deal of grain, which became the prey of birds. This experiment, if it anſwered no other end, is at leaſt a proof of the goodneſs of the new huſbandry.

" The good ſucceſs of theſe little experiments, was a ſtrong inducement to me to make more conſiderable ones: but in order to this, it was neceſſary to be provided with a proper hoe and drill-plough; for I muſt confeſs that Mr. Tull's did not appear to me to be ſuch. It's great fault is, that it is too complex.

" Being provided with a proper hoe-plough, I ſoon became ſenſible of the advantages of it. Num-

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* M. Duhamel obſerves, that it is very ſingular that wheat, eight years old, ſhould ſprout ſo well; for that he ſowed ſome of ſeven years old, which did not riſe at all.

bers of ſuch ploughs are already uſed in this country; and, which is ſaying a great deal, even our farmers make uſe of them.

“ This is the plough which I uſed all this ſummer in preparing my ground. It did admirably well in the alleys of my experiment, after the corn was above four feet high. No plant was hurt by it, and I could bring the plough as near to them as I pleaſed. Thus it fully and conveniently performs this hoeing, in which I have ſeldom uſed more than one horſe. I have likewiſe prepared with it the ground ſowed with wheat this autumn.

“ My new hoe and drill-plough have made it eaſy for me to enlarge my experiments this year. However, I thought it moſt adviſeable to proceed by degrees; and have therefore reſtricted myſelf to the culture of about ten acres, according to the new husbandry, part of which is in a very ſtrong ſoil, part in a very light ſoil, and part in a midling and ſtony ſoil.

“ What I have had chiefly in view in my experiments this year is, *to know exactly what quantity of ſeed will produce the moſt plentiful crop.* To this end, I have ſowed wheat in different degrees of thickneſs; dropping the grains ſome at one inch, ſome at two, and ſo on, to the diſtance of ſix inches from each other.

“ All this wheat has at preſent a fine appearance, and the plants are infinitely ſtronger than thoſe in the common fields: their blades are much larger, and of a very deep green colour. What is more, they have already branched, and promiſe a great number of ſtalks. I have counted on ſome plants 20, and on others 25. Upon the whole, there is great reaſon to expect a plentiful crop.

“ I have made another experiment with the drill plough, with which I have ſowed ſome of my common fields. Inſtead of diſtributing the ſeed by hand, in the broad-caſt way, as in the old huſbandry,

bandry, I have ſowed the whole field with this inſtrument, without leaving any alleys. This has ſaved a great deal of ſeed; having employed only twelve pounds of eighteen ounces, to ſow the ſame extent of ground as uſed to be ſowed with 110 pounds. Yet I think this ſufficiently thick: the plants are very fine, and of a deep green. They have already begun to branch, and promiſe many ſtalks. Hitherto my wheat gives me reaſon to be pleaſed with the experiment I am making. I have ſowed about thirty acres in this manner."

Experiments made by M. LULLIN DE CHATEAUVIEUX, *in the year* 1752[c].

"MY experiments this year are of three kinds. The firſt was made on the ſame ſpot as the laſt year's experiment: the ſecond, on a piece of ground which was made into beds for the firſt time; and the third, on a field plowed in broadlands in the common way, but ſowed with the drill-plough, in equally diſtant rows, without any intermediate alleys.

Firſt EXPERIMENT, No. I.

"I HAVE already mentioned *, that this ſpot was ſowed with wheat, the beds being now made in the middle of the former alleys. The ſummer hoeings had brought this ground to ſo fine and looſe a ſtate, that, after one plowing, I ſowed the three beds with the drill-plough, on the twenty-fifth of September; and to prevent the accidents I before met with, I increaſed the quantity of ſeed to nine ounces fifteen pennyweights.

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[c] DUHAMEL, *Culture des Terres, Tom.* II. *Par.* 3. *c.* 1.

* P. 125.

" The wheat roſe extremely well, and the rows were full of plants, which became very ſtrong and thriving before the winter. Though ſnails deſtroyed a great number of them, as they had done the year before, yet, I judged the rows ſufficiently ſtored with plants, and thought that this accident would do no great damage to the crop.

" The winter was pretty favourable to corn in general. My plants made very ſtrong ſhoots in the ſpring; but I found ſome chaſms in the rows which I had not perceived in the autumn. I imputed this in ſome meaſure to the inclemency of the winter, which had undoubtedly deſtroyed ſeveral weak plants. Theſe chaſms were but few, and the worſt of them had about two plants in fifteen inches.

" I horſe-hoed the alleys for the firſt time on the ninth of March, and a ſecond time on the twenty-fifth of May. The ground was in ſo looſe a ſtate, that I thought it needleſs to hoe it afterwards, eſpecially as the wheat was in an exceeding good way. It continued of a very deep green till it ripened; the blades were extremely large; and the plants branched much more than they had done the year before. It was a common thing to find plants with between 60 and 70 ſtalks, which, in general, grew to above five feet and ſome inches high, and were crowned with large ears quite full of grain.

" As ſoon as the wheat had done bloſſoming, I found it neceſſary to defend it againſt the birds. Thanks to the care that was now taken, they did it leſs hurt this year than the laſt: but ſtill they eat a great deal of it, though I cannot preciſely determine the quantity.

" As ſoon as the wheat appeared to be near ripe, in order to preſerve it from the farther plunder of thoſe robbers, I reaped it, on the twentieth of July, though I would rather have choſen to let it ſtand five or ſix days longer. It remained in the field four days, to dry, and was threſhed towards the latter end of Auguſt. It yielded an hundred and forty-two pounds of wheat, at eighteen ounces to the pound.

" This wheat was very fine, perfectly clean, and the grain much larger than in the common way.

" This experiment gives juſt riſe to the following remarks:

" Firſt; the earth of theſe three beds having been pulveriſed and brought to a very looſe ſtate by the horſe-hoeings in 1751, the plants were ſtronger and more thriving than thoſe of the year before; a circumſtance which contributed to the increaſe of the crop.

" Secondly; this crop juſtifies my eſtimate, that this ſpot of ground could yield 210 pounds of wheat in one ſeaſon, if cultivated according to the principles of the new husbandry: for if we add to the 142 pounds reaped this year, the loſs occaſioned by the birds and ſnails, it is pretty evident that the whole produce would have nearly amounted to 210 pounds.

" Luckily, that I might be more thoroughly ſatisfied what loſs I ſuffered by the birds, I counted in two different places how many ſtalks the plants in the three rows had yielded. On a length of ten feet, I found 1600 in one place, and 2030 in another. As I would always avoid over-ſtraining my calculations, I ſhall only ſuppoſe that every ten feet in length produces 1600 ſtalks: the beds, being 160 feet long, will conſequently contain at leaſt 25600 ſtalks, and the three beds together 76800 ſtalks, or ears.

" To know, in the next place, how many pounds of wheat might be contained in that number of ears, I had as many of them threſhed, a month after harveſt, as yielded a pound of eighteen ounces. They were taken at random, without culling them, out of a ſheaf which ſeemed to have been but little damaged by the birds.

"Three hundred and ſixty ears yielded thoſe eighteen ounces of wheat: ſo that, dividing 76800, the whole number of ears, by 360, the produce of the crop would be 213 pounds 6 ounces, at eighteen ounces to the pound, or 240 pounds of ſixteen ounces. Hence it appears, that my firſt eſtimate was pretty juſt, and that the produce may be even more conſiderable hereafter.

"Thirdly; this ſpot was clear of weeds; though it uſed to be over-run with them. It appears by this, that the new huſbandry deſtroys them effectually; though this advantage will be leſs felt the firſt year, than in other ſubſequent years.

"From the obſervation which I made, that the plants were in a more thriving ſtate this year, than in 1751; it follows, that the earth, far from having been exhauſted by the nouriſhment it had yielded the plants during that year, became more fruitful in this: which can be imputed only to the new culture; the land having received no other aſſiſtance, either by dung or manure.

"The wheat was this year, upon a very exact ſearch, free from ſmut or blight. I found but one blighted ear, though there were numbers of ſuch in the fields contiguous to mine. I cannot however impute this favourable circumſtance to the new culture alone: it may have contributed thereto, and may leſſen the quantity; but to be ſure of that requires the experience of ſome years."

EXPERIMENT, No. II.

" THIS experiment was made on a larger piece of ground, formed into beds ſix feet wide. The diſtance from the middle of one bed to the middle of the next, was alſo ſix feet*; and the whole extent of the ſpot was about an acre and a quarter. Each bed was ſowed with three rows of wheat.

" The ſmall quantity of ſeed with which this ground was ſowed, certainly required that every grain ſhould grow: but the intended number of plants fell greatly ſhort, ſeveral of the grains not riſing at all, and many of thoſe which did riſe, being deſtroyed by inſects. The greateſt damage was done by ſnails. There were great chaſms in the rows, without any plants. As far as I could judge, between a third and fourth part of the rows did not produce any thing.

" The hoeings were performed this year at proper ſeaſons, and rather more frequently to make up for the neglect of the former year: for the ground was not in ſufficiently fine tilth when the wheat was ſowed.

" On the fourteenth and fifteenth of October 1751, the alleys were plowed for the firſt time before winter.

" On the ninth and tenth of March 1752, they were plowed again for the firſt time after winter.

" From the eighteenth to the twenty-fourth of April, the ground was weeded.

" On the twenty ninth of April, the alleys were ſtirred with the cultivator; which was again repeated on the twenty-fifth of May and the ſeventh of June.

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* We ſhall hereafter find that there is no occaſion for ſo great a diſtance.

“ This wheat made a fine appearance; the length of the ſtalks, and the largeneſs of the ears, ſhewed how much the new culture promoted the growth of theſe plants, which branched nearly as much as thoſe of No. I. This field was reaped on the twenty-fifth of July.

“ I ſhall join to the account of what this crop produced, an eſtimate of what might have been expected if the ſame ground had been cultivated in the common way.”

Compariſon of the produce of the ſame field, cultivated according to the old, and according to the new huſbandry.

“ THIS field, which is of a very good and ſtrong ſoil, was very badly plowed laſt year by reaſon of the frequent and heavy rains, and had not been dunged for ſeveral years. In the common way, it uſed to be ſowed with 318 pounds of wheat. This year, it was made into beds ſix feet wide, and was ſowed, on the twenty fifth of September, with only 10 pounds of wheat.

Produce of this field under the new culture in 1752.

“ This field, laid out in beds, produced, of very fine large grain'd wheat,		926 lb.

To be deducted.

“ Though this wheat was very clean, yet four parts in a hundred were ſifted from it, as ſmall corn; valued at	37 lb.	47 lb.
“ For the ſeed ſown - -	10 lb.	
Neat produce - -		879 lb.

“ In

" In this huſbandry, the ſame field is ſowed every year; ſo that, ſuppoſing the crop of 1753 to be only equal to this of 1752, (and there is no doubt but it will be greater) it will again produce		879 lb.
Amount of the two crops		1758 lb.

Produce of the old culture.

" If we judge of it by the beſt crops of former years, it will be three times the quantity of the ſeed, viz.		954 lb.

To be deducted.

" Loſs by ſifting, 15 *per cent.* It has often been 25 and 30 *per cent.* and even more. Every time this field was ſowed, the corn was lodged, which prevented the ears from filling, and rendered the grains ſmall and ſhrivelled	143 lb,	461 lb.
" For the ſeed	318 lb.	
Neat produce		493 lb.
" Conſequently the balance, in favour of the new husbandry, is		386 lb.
		879 lb.

“ As this field yields but one crop in two years, in the common husbandry, it would produce in that ſpace only	493 lb.
“ From whence it follows, that the neat profit of the new culture in the ſame ſpace of time, exceeds the other by	1265 lb.
	1758 lb.

“ Suppoſing this field never to produce a greater crop than that of this year, it is evident that it is beſt to follow the new method. But we can already promiſe, that the ſucceeding crops will be more plentiful. The field is now ſown in the new way; it has not yet ſuffered any damage by inſects; and the rows are well ſtored with plants, whoſe more thriving ſtate promiſes a better crop than that of the laſt year.

“ It may perhaps be thought odd, that I ſhould limit the produce of the field ſowed in the common way, to three times the ſeed. I know there are lands in this country which yield more, *viz.* four or five times the ſeed, and ſometimes upwards: but then it muſt be granted, that there are but few ſuch lands; and that they are fields in extraordinary fine tilth, and enriched with manure. I therefore ſpeak of our lands in general, taking good and bad together. In this caſe, I ſay, the produce, one year with another, will not exceed three for one.

“ My fields have always been as well cultivated as any in the country. I have computed the amount of my crops for ſixteen years running, *viz.* from 1730 to 1745, incluſively. Theſe accounts were carefully kept by a ſteward who died a few years ago, and I do not find that the produce ever was greater than what I have been ſaying, one year with another.

EXPERIMENT, No. III.

" About an acre and ſeventeen poles of ground, in another field, was laid out in beds like the former. This land, which is very ſtrong, was but in bad tilth, notwithſtanding the care I took to break the earth thoroughly, and reduce it into ſmall particles. Frequent rains were the cauſe of this. It was ſowed with the drill-plough on the twenty-fourth of September. Only ſeven pounds of wheat were uſed. The plants roſe pretty well: but, towards the end of autumn, they were deſtroyed daily by inſects, and thereby reduced to a very ſmall number, which greatly diminiſhed the crop.

" On the ſixteenth of October 1751, the alleys were plowed for the firſt time before winter.

" On the tenth and eleventh of March 1752, they received their firſt plowing after winter.

" On the firſt of May, the ground was weeded.

" On the twenty-third of May, the alleys received their ſecond ſtirring with the Cultivator, and on the twelfth of June they were plowed.

" The plants which came up were very fine, and branched greatly: the ears were like thoſe of the experiments I have already mentioned, and the grain equally large. Though the produce was but 392 pounds, yet it is a fine crop for the ſmall number of plants that eſcaped unhurt.

" As I know the cauſes to which the ſcantineſs of this crop was owing, I make no doubt but it will equal that of any of the other fields next year. It is now ſowed, for the ſecond time, in the new way. The rows are well ſtored with plants, and the corn is in as good condition as can be deſired."

EXPERIMENT, No. IV.

"THIS experiment was made at the diſtance of ſix miles from my houſe, on a light poor ſoil, which induced me to dung * it. The beds were about ſix feet wide, and were ſowed on the twenty-firſt of September with three pounds and three quarters of wheat, which produced fine plants and large ears, and yielded 196 pounds. Though the earth had not been well ſtirred, nor at proper ſeaſons; yet the corn ſowed in it, produced greatly. The dung undoubtedly helped to make up for the want of due culture."

EXPERIMENTS

Made on fields ſown in equally diſtant rows, with the drill-plough.

No. V.

"I Have ſowed fields cultivated in every reſpect in the common way, except in the manner of diſtributing the ſeed, which was done with the drill-plough. The whole field was covered with rows of wheat, diſtant from each other ſeven inches and a half†.

"The advantages which I propoſed to myſelf by ſowing in this manner, were, firſt, the ſaving of ſeed and preventing the earth from being overſtocked with plants; ſecondly, burying the ſeed at

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[*] M. Duhamel obſerves, that though dung may generally be ſpared in the new huſbandry; yet it certainly is of conſiderable uſe, eſpecially in poor lands.

[†] M. de Chateauvieux calls this method of ſowing, *ſemer en plein, to ſow in full.* We ſhall expreſs it by, *ſowing in equally diſtant rows*, in oppoſition to fields laid out in beds and alleys.

at a proper depth; thirdly, having the plants at equal diſtances: and laſtly, the little ſtirring of the ground and breaking of the clods, which the drill plough effects at the ſame time that it ſows. Theſe things ſeemed to me more likely to be attended with ſucceſs, than the common way of ſowing.

"The plants of this wheat were very fine; their deep green colour ſhewed their ſtrength: the largeneſs of their blades, and the number of their ſtalks, ſhewed likewiſe that they found greater plenty of nouriſhment than wheat in the common way. The plants had, in general, four, ſix, eight, ten, or more ſtalks; ſo that theſe fields, which, till the month of April, ſeemed ſcarcely to have been ſown, changed then ſo as hardly to be known again, by the number of ſtalks which ſhot forth at that time. The wheat was taller than that in the common way, and the ears larger and better filled with grain.

"An account of the produce will ſhew what may be expected from this manner of ſowing.

"*Account of the produce of the ſame field ſowed part in the old way, and part with the drill-plough, on the fourteenth, fifteenth, and ſixteenth of September* 1751.

"THE whole of this field uſed commonly to be ſowed with twenty meaſures of wheat, each meaſure containing 106 pounds of 18 ounces. Three meaſures, or 318 pounds of wheat, were ſown in the uſual way in the richeſt part of the field. The remaining part, which would have required 1802 pounds in the common way, was ſowed with the drill-plough, with only 265 pounds.

"The ſoil was middling, neither too ſtrong, nor too light, and pretty ſtony. The land was poor,

becauſe

becauſe it had not been dunged, which indeed it ſeldom was, the owner not having more than was neceſſary for his vines.

Produce of the new huſbandry.

The 265 pounds of wheat produced		5450 lb.

To be deducted.

For ſmall and bad grain ſifted out, 4 *per cent.*	218	483 lb.
For the ſeed	265	
Neat produce.		4967 lb.

"If the other part of the field, which was ſowed with the three meaſures in the old way, had been ſown with the drill-plough, it would have yielded	960 lb.

To be deducted.

Loſs by ſifting, 4 *per cent.*	38 bl.	84 lb.	
For the ſeed	46 lb.		
Neat produce to be added to the above			876 lb.
Neat produce of the whole			5843 lb.

Produce of the old huſbandry.

"That part of the field which was ſowed with the three meaſures of 106 pounds each, produced thrice the quantity of the ſeed, mixed with bad grain. The ſame meaſure of this grain weighed but 103 pounds. This field yields no more even in the beſt years. If the whole of it had been ſowed in the old way, it would have produced 6180 lb.

To be deducted.

Loſs by ſifting, 15 *per cent.* It has often been 25, and 30 *per cent.*	927 lb.	3047 lb.
For the ſeed	2120 lb.	
Neat produce		3133 lb.
Ballance in favour of the new method		2710 lb.
		5843 lb

EXPERIMENT, No. VI.

"I Sowed, continues M. de Chateauvieux, another field of about three roods and fifteen poles in the ſame manner, with thirty pounds of wheat reckoning 18 ounces to the pound, on the twenty-fourth of September. The ſoil was ſtrong, and in fine tilth. The wheat grew in every reſpect like that of the preceding article, with this only perceptible difference, that the ſtraw was ſomewhat longer, and the ears larger. It was not threſhed till the beginning of December, and yielded 809 pounds of very fine wheat (the pound 18 ounces). The produce of this field was greater than that of the former, in proportion to the quantity of ſeed. But the ſoil of this was better, and in finer tilth."

EXPERIMENT, No. VII.

"THIS experiment was made about three miles from me, on a piece of ground of the extent of about 2 roods and 27 poles. This land is neither too ſtrong, nor too light, and may be called a pretty rich ſoil. It was plowed three times, like other lands, and had not been dunged for many years. It uſed to be ſowed with 165, or 170 pounds of wheat. It was now ſowed, on the 5th of October, with only 24 pounds. Though the ſeaſon was ſo far advanced, this ſeed came up pretty well before winter. The plants throve greatly in the ſpring, and the field became covered with ſtrong ſtalks, and very large ears, full of fine plump grain.

" The crop yielded 800 pounds of clean wheat, without mixture of any other ſeeds. Deducting from this the 24 pounds of ſeed, the neat produce is 776 pounds. This field, when ſowed in the common way, produces, in the beſt years, about 875 pounds; from which if we deduct 165 pounds for the ſeed, the neat produce will be 710 pounds. Thus we ſee that the ſame ground ſowed with the drill-plough, produced 66 pounds more than when ſown in the common way. But as wheat raiſed in this laſt way is always mixed with abundance of ſeeds of weeds, which muſt be ſeparated by ſifting, an allowance muſt likewiſe be made for that; and the profit will then not be limited to the 66 pounds only, which the owner reaped more than in the common way.

" I omit ſeveral experiments of wheat ſowed in beds, and with the drill-plough, in equally diſtant rows, the ſucceſs of which has been nearly equal to that of thoſe I have already ſpoken of. I ſhall mention only one more, and that on account of a circumſtance which deſerves to be known. I made it on a light ſoil, the worſt I knew of, full of pretty large ſtones, and which had not been dunged in the memory of man. The ſtones did not hinder the drill-plough from dropping the ſeeds very regularly. I choſe this bad ſoil, on purpoſe to ſee how wheat would thrive in it. I allowed too little ſeed, conſidering the badneſs of the ground. The ſtones prevented many plants from riſing, and many more were deſtroyed by inſects; ſo that the corn was very thin, and the crop ſmall. I was however pleaſed with it, becauſe I found the plants grew almoſt as ſtrong as in a good ſoil, and the ears were as large, and as full of grain.

"A little before harveſt, the wheat of all theſe experiments ſuſtained many heavy rains, accompanied with very high winds; and though the ſtraw was much longer than that of the wheat which had been ſown in the common way, the corn was not lodged; whilſt a great deal was laid flat in the neighbouring fields. Some indeed was bent; but that is different from being *lodged.* This laſt ſituation is very hurtful to the filling of the grain; but its being *bent*, is attended with no inconvenience *. I am even inclined to think that it may be of ſervice to the wheat, not to remain in a perpendicular direction; and intend next year to be particularly attentive to this.

"It is not at all to be wondered at, that plants ſown in the common way, ſhould not thrive ſo well as thoſe which grow in beds. The former, not having been aſſiſted by the ſtirring of the mould, cannot draw ſo much nouriſhment from the earth, as thoſe in beds. The ſize of theſe laſt has indeed exceeded my expectation. There is reaſon to be ſatisfied with this manner of ſowing, even if it were attended with no greater advantage than this year's crops afforded. But if the quantity of ſeed is increaſed, ſo that the field be ſtocked with as many plants as it can nouriſh, the profit will be ſo much the more conſiderable.

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* **We were therefore right, ſays Mr. Duhamel, in obſerving that corn would be leſs liable to be lodged in following our method, than in proceeding in the common way.**

"It is time to return to our experiments on fields laid out in beds, which are the more immediate object of the new huſbandry.

"Thoſe which I have made this year, have not brought the produce of the new culture to near what it will be hereafter; as will appear from what I ſhall next obſerve."

Reflections of M. de Chateauvieux, *which prove the truth of the principles on which the new huſbandry is founded.*

"WE ſee by the experiment, No. I. that the earth, by being in a looſer or more divided ſtate the ſecond year, is fitter to afford a greater quantity of nouriſhment to plants, whoſe productions will always be proportioned to the eaſe with which they can reach that nouriſhment.

"I was in hopes that the experiments of this year would have enabled me to determine what quantity of ſeed it is beſt to ſow, in order to obtain the greateſt crop. The lands on which I ſowed the moſt ſeed laſt year, ſhewed me plainly, that it would be right to increaſe the quantity, in order to provide againſt the accidents by which the plants had been thinned too much.

"But this increaſe of ſeed ſhould be regulated with great diſcretion, regard being had both to the circumſtances of the ſeaſon in which the ſeed is ſowed, and to the condition of the ground in which it is planted. If the ſoil is in very fine tilth, leſs ſeed will be ſufficient.

"The experiments of this year ſhew, that there are but three principal means by which we can obtain the utmoſt production that plants are capable of affording: Theſe means are practicable only in the new huſbandry: for in that alone each bed has the number of plants it can properly nouriſh; which is the ſource of plenty.

" The firſt means is, to make the plants produce a great number of ſtalks.

" The ſecond is, to make each ſtalk bear a large ear.

" The third is, to make each ear be quite full of plump grain.

" Theſe effects cannot be obtained in the old huſbandry, becauſe they can only be procured by frequently ſtirring the earth.

" All my experiments this year ſhew the truth of this: but eſpecially the experiments No. I. and II.

" It is therefore by ſtirring the alleys while the plants are yet young and growing, that we can *make them produce a number of ſtalks, cauſe thoſe ſtalks to bear large ears, and fill each ear with large plump grain.* But to obtain theſe advantages, it is of great conſequence that the hoeings be performed at proper ſeaſons; each having its peculiar effects.

" The plowing before winter, *is intended to drain off the water*; which, if it ſhould remain long near the plants, would chill and greatly hurt them; *and to lay up the earth to be mouldered by the winter's froſt.* It is hereby enabled the better to ſupply the plants with their neceſſary food in the ſpring. This may be done at the farmer's conveniency, from the time that the plants have three or four blades, till the froſt ſets in: and even in the winter, if it does not freeze, plowing will always be of ſervice.

" The firſt plowing after winter is of great importance. *It is to this that we owe the number of* *ſtalks which the plants produce.* That it may have this effect, it muſt be performed as ſoon as the ſevere colds are paſt; and, at lateſt, as ſoon as the plants begin to ſhoot. If it be delayed longer, it will contribute very little towards their branching. It will ſerve only to make the ſtalks grow longer. If any new ones ſhoot out, they will not thrive ſo well as the firſt; and therefore it is of great conſequence that they ſhoot out all together.

"The hoeings which are performed from this time, till the wheat has done bloſſoming, *ſtrengthen the plants, lengthen their ſtalks, and enlarge their ears.* The ſeaſon of theſe hoeings is not ſo exactly limited as that of the former, and the frequency of them will depend greatly on the ſtate of the ground; for it muſt not be touched when it is too moiſt. If the ſeaſon is kindly, they may be repeated two, three, or four times: but I think one hoeing highly neceſſary juſt before the ears break forth. They certainly grow longer and larger by it.

"The laſt hoeing is the moſt important of all, and that which can leaſt be diſpenſed with. It muſt be performed as ſoon as the bloſſom is gone off the wheat. *This fills the whole ear, and ſwells the grain.*

"When farmers become ſenſible of the good effects of theſe frequent ſtirrings, they will not neglect to repeat them at the proper ſeaſons. It is by a ſucceſſion of them, that, in my opinion, crops may be brought to their higheſt perfection: and if unfavourable ſeaſons prevent their being given at their proper times, a diminution of the crop will moſt aſſuredly enſue.

"No one who conſiders the produce of the ears of corn on lands cultivated according to the new, and the old huſbandry, will, I believe, doubt which of theſe is to be preferred. I ſhall beſtow a few moments, to point out the difference which I have found between the one and the other.

"I ſaid before, that 360 ears yielded me 18 ounces of wheat. Here is a determined fact; and I am certain that I have not enlarged it; becauſe the birds had eaten ſome of the grain: otherwiſe fewer ears would have produced thoſe 18 ounces.

"When, in the year 1750, I firſt began to inquire into the principles of the new huſbandry, I judged that it might be of ſome importance to know what is the uſual produce of a plant of wheat when cultivated in the common way. That year was reckoned a very good one for wheat, which appeared clean and good as it ſtood upon the ground. I took this method to come at the knowledge I wanted.

"I took part of a ſheaf which appeared to me very good, and which was the produce of a very rich field. I divided it into three parcels. In the firſt parcel were all the good ears: the middling and ſmall ears were in the ſecond, and the ears in which there was no grain, or where the grain was faulty, compoſed the third.

"The wheat being thus divided, I counted the number of ears in each parcel. I found 400 in the firſt, which conſiſted of the beſt ears; 1600 in the ſecond, which contained the middling and ſmalleſt ears; and in the third, 750 ears, or plants whoſe grain was faulty. I made no account of a great number of imperfect ſhoots, which were not ſix inches long.

"The fields did not look ſo poor to the eye, as this ſeparation proved them to be. This firſt operation was therefore neceſſary to come at the truth.

"When the grain was cleared from the ears, I found, that the 400 ears contained five ounces and a half of wheat, and that the 1600 contained ſeven ounces.

"My curioſity did not lead me to inquire into the contents of the third parcel; knowing that there was no good grain in it.

"In the purſuit of this inquiry, I found that, taking one ear with another, of the 400, there were but *eleven grains of wheat in each*; and that in the 1600, taking one ear with another, there were but *three grains and a half* to an ear. Eight hundred of theſe grains weighed but an ounce.

"If we add theſe parcels together, we ſhall find that 2000 ears yielded but 12 ounces and a half of wheat, and that it would require 2890 ears of the ſame goodneſs to yield eighteen ounces,

"I confeſs that I was aſtoniſhed at the reſult of my inquiry; which I could not have believed if I had not ſeen it. But at the ſame time, how greatly was my expectation raiſed, of the advantages of the new culture!

"I have this year formed a greater extent of ground into beds. Too frequent rains have prevented my laying down more than 30 acres in this manner: but I have ſowed all the reſt of my farm with the drill-plough in equally diſtant rows. I have increaſed the quantity of ſeed; regard being had to each circumſtance neceſſary to be attended to; ſo that in ſome fields I have ſown double the quantity of ſeed that was employed in the year 1751; in others ſomewhat more, and in others again leſs.

"All my fields look extremely well, and make a much better appearance than they did laſt year. They are abundantly ſtocked with very ſtrong plants, of a deep green colour: the blades are long and large, and cover the earth better than the common wheat.

"Hitherto, theſe plants have not ſuſtained any loſs, except in one ſpot of about half an acre, where they were gnawed aſunder, juſt under the ſurface of the earth, by inſects. I immediately ſowed it again, and by this means have quite repaired the damage. The inſects have not appeared ſince.

" One of the moſt happy effects of my experiments, is, that they have created a deſire in many perſons in theſe parts, to begin the practice of the new huſbandry, with trials of conſiderable extent. One perſon, convinced of its excellency, has laid out and ſowed at leaſt twenty-eight acres in beds: another has ſowed with the drill-plough, an hundred and fifty acres plowed in broad lands. All the land that has been ſowed in beds amounts to about fifty acres: and upwards of two hundred acres,, in broad lands, have been ſown with the drill-plough. Fvery one who has ſeen theſe fields, even the very plowmen not excepted, agree that they look extremely well, and that they never ſaw, in this country, plants of ſuch ſtrength and vigour as the wheat that was firſt ſown.

" I am extremely happy that my drill-plough has been of ſo general uſe. It has performed regularly every where: people having ſowed with it exactly the intended quantities of grain."

Experiments made by M. LULLIN DE CHATEAUVIEUX, *in the year* 1753[d].

" I Am the better pleaſed with being able to give a ſatisfactory account of the ſucceſs of my experiments this year, as the ſeaſons have not been favourable, and extraordinary accidents have greatly diminiſhed the produce of the crops.

" I ſhall divide this account into ſeveral articles.

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[d] DUHAMEL, *Culture des Terres, Tom.* III. *p.* 74. *2e. Edit.*

" The firſt will contain the experiments made on lands laid out in beds, which have borne their ſecond and third crop. To this will be added ſome obſervations relative thereto.

" The ſubject of the ſecond will be a detail of experiments made on lands formed into beds, which have yielded only their firſt crop. This too will be followed by ſome remarks.

" The third will conſiſt of the experiments of two perſons, on lands made into beds, of which the firſt crop was reaped this year: to which will be ſubjoined ſome neceſſary reflections.

" The fourth article will contain an account of ſeveral experiments made by divers lovers of Agriculture, on lands ſown in equally diſtant rows, but with the drill-plough.

" As we think it will be extremely uſeful to ſhew, by the experiments which have been made this year, that lands produce more corn in the new husbandry, than in the old; we ſhall give an account, in the fifth article, of the crops of fields ſown in the common way for ſixteen years together; and of thoſe of the ſame fields cultivated according to the new husbandry, ſuppoſing them not to yield better crops in future years, than they have done in this; a ſuppoſition the leaſt favourable that can be to the new culture, ſince we calculate only upon the produce of the firſt year's crop, and that too diminiſhed by the extraordinary accidents which we ſhall mention.

" To ſhew the truth of this article more fully, it will be proved in the ſixth, that the beſt field in the country, though it had been well dunged, yielded leſs wheat than thoſe on which the experiments were made, and on which no dung was uſed.

" The ſeventh article will conſiſt of reflections and obſervations on our practice of the new huſbandry;

bandry; and the eighth will ſhew the diſpoſition of our lands for the crop in 1754.

"To avoid repetitions, we ſhall obſerve here, once for all, that no dung or other manure was uſed in any of our fields, and that our pound conſiſts of ſixteen ounces.

ARTICLE I.

Experiments made on lands laid out in beds, which had born a ſecond and third crop, with ſome obſervations particularly relating thereto.

EXPERIMENT, No. I.

N. B. *This experiment is marked with the ſame number in the year* 1752. (p. 133)

"I Should have known the full produce of this third ſucceſſive crop on the beds of this field, continues M. de Chateauvieux, if the hail which fell on the third of June had not damaged it greatly. The abundance of rain which fell at the ſame time, and immediately after the hail, did ſtill greater hurt; for the earth of part of the beds was waſhed away by the torrents of water, ſome of the plants were forced out of their places, others were entirely covered with earth, and many were torn up by the roots; ſo that it was not poſſible to judge what this year's produce would have been, by the few plants that were left.

"I am very ſorry that this accident deprived me of a certain proof, that this year's crop would have been more plentiful than that of 1752: for it would have been evident, that the earth becomes more and more fruitful by the new husbandry: a truth, which it is of conſequence to eſtabliſh. I can

I can therefore only affirm by conjecture, that this crop would have been greater. My conjectures are indeed ſo ſtrong, that they amount almoſt to a demonſtration.

" I draw them from hence; that the corn had a very fine appearance before winter; that the plants grew with great ſtrength in the ſpring; that they branched more than formerly; that the ears were certainly larger; that they bloſſomed extremely well; (they were in full bloom by the thirtieth of May;) and laſtly, that they have yielded more ſtraw than in 1752.

" It neceſſarily follows from hence, that had it not been for the hail and torrents of water, the crop would have been greater than in 1752.

" Though the following experiment ſuffered the ſame accidents, (except that the beds were not broken up by the water,) it will ſupply the want of that information which we were deprived of in the other, and ſtrengthen our conjectures.

EXPERIMENT, No. II.

N. B. *This experiment is marked with the ſame number in the year* 1752. (p. 137)

" AS I hope this experiment will be found very inſtructive, I ſhall relate it with the ſame care as it was executed. I therefore beg it may be particularly attended to; for it will confirm the advantages of the new huſbandry. But before I enter into a detail, of which I ſhall endeavour not to omit any eſſential circumſtance, it is neceſſary to repeat here, that in the journal of 1751, I ſaid, 1. that the plowings which had been given in order to prepare the ground for being ſown in 1752, had not looſened it ſufficiently, and that I tried to remedy this defect by ſubſequent culture. 2. That this field was ſowed on the twenty-fifth of September with eleven pounds and four ounces of wheat. 3. That the crop yielded a thouſand and forty two pounds twelve ounces; and laſtly, that the appearance of the young plants promiſed a much greater crop in 1753.

"The culture beſtowed upon theſe lands in 1752, rendered them more and more looſe and well divided, ſo that with only one plowing after harveſt, which was performed with eaſe, I formed new beds, the ridge of which was now in the place where the furrow in the middle of the alley was before. But the earth was ſtirred deeper and made much looſer, than in 1752. I had already attained almoſt a perfect tilth, and eaſily foreſaw that I might quite complete it in 1753.

"Whilſt I laboured aſſiduouſly in the culture of wheat, from which I would not ſuffer any thing to divert my attention too much, till I ſhould arrive at a good and certain practice of the new huſbandry; I nevertheleſs determined to begin experiments on lucerne and ſainfoin, to cultivate them nearly in the ſame manner as wheat. What prompted me to this, was the ſucceſs of a ſmall experiment the year before. Accordingly, taking this object likewiſe into ſerious conſideration, I reſolved to leave a part of this field for lucerne, and to ſow the reſt with wheat. It contained in all 1 acre, 1 rood, and 18 poles, formed into 45 beds. I left for the lucerne, nine beds, the extent of which was about a quarter of an acre; and deſtined the ſurplus to be ſowed with wheat, as before. I am now very attentive to the experiments on lucerne and ſain-foin, and ſhall begin next year to give an account of them, and of my manner of proceeding. My practice, in this, will be found different, in many reſpects, from the method which is commonly purſued. I will venture to affirm, that there will be room to be ſatisfied with the ſucceſs of this branch of husbandry, than which none can be more intereſting; plenty of fodder being as neceſſary as plenty of corn.

" I muſt therefore beg leave to give the produce of this field, as if the whole of it had been ſowed with wheat. This I do in order to compare the produce of 1753. with that of 1752; as it cannot be doubted but that the nine beds now under lucerne, would each of them have yielded as much wheat, as any of the beds did that were ſown with it: nay, perhaps ſome pounds more; the lucerne being ſown in what I thought the richeſt part of the ground. This field was ſowed on the firſt of September. I encreaſed the quantity of ſeed, ſowing this time thirty four pounds fourteen ounces of wheat; whereas in 1751, I ſowed but eleven pounds four ounces. Though I ſowed this year more than thrice the weight of ſeed that I did in 1751, it muſt not be inferred that I tripled the number of grains capable of producing plants, becauſe this year's ſowing was made with wheat of the produce of the new culture, the grains of which are much larger than thoſe of the common wheat which I uſed in 1751, and of which a greater number is conſequently required to make up an equal weight.

" This wheat having been ſown pretty early, it's plants had time to grow very ſtrong before winter, the cold of which they bore very well: and the plowing I gave them on the fifteenth of October, by cutting a very deep furrow within about three inches of the rows, ſecured them from the damage which corn frequently ſuffers from rain and the melting of ſnow.

" In the ſpring, they made ſtrong ſhoots, grew apace, and branched very abundantly. I aſſiſted them, as I am going to relate, at proper ſeaſons, both with reſpect to the condition of the plants and earth, and to the temperature of the weather.

" On the fifteenth of March, 1753, I gave them the firſt plowing after winter.

" On the twenty-ſixth, the beds were weeded.

" On the eleventh of April, I ſtirred the allies with the cultivator.

" On the twenty-ſixth, the thiſtles were plucked up.

" On the fourteenth of May, the ſtirring was repeated with the plough.

" On the fifteenth, the ears began to appear.

" On the twenty-ninth, the fourth ſtirring was given with the cultivator with mould-boards.

" On the thirtieth, the wheat was in full bloom.

" On the third of June, the wheat ſuſtained a violent ſtorm of hail and rain.

" On the thirteenth, the fifth ſtirring was given with the new plough with two ſhares, or double cultivator.

" I beg leave to obſerve, that there needs no better proof that wheat, cultivated according to the new huſbandry, will be little apt to be lodged, than the eaſe with which I performed the fifth culture, after the accidents which happened on the third of June, when the corn had attained it's greateſt height. So far was it from being laid thereby, that the whole extent of the plough found free admittance into the alleys, and this laſt culture could be given without damaging the ſtalks.

" Though the whole of our plowing and hoeing may be performed extremely well with my plough and the inſtrument which I call the *cultivator*, yet

I have thought of making this taſk ſtill more eaſy. Two new inſtruments, (not indeed abſolutely neceſſary,) will anſwer this end. I propoſe them only as very uſeful, and proper to be employed only the ſecond or third year, when the earth has acquired part of that minute diviſion, of which it is ſuſceptible.

" The cultivator with mould-boards,] and the plough with two ſhares, are inſtruments which I have invented this year. I have found them extremely uſeful to give the two laſt ſtirrings, better, and in leſs time than our other inſtruments. The reader may not be diſpleaſed to know what firſt ſet me upon contriving them.

" One cannot enter properly into the ſpirit of the new huſbandry, without being thoroughly convinced that the earth cannot be too minutely divided: I will even ſay, till it is reduced to a perfect powder: and that, when one has been ſo happy as to attain this point, it muſt be kept in that ſtate. This will always be done beſt, by uſing the moſt proper inſtruments.

" I obſerved one day, whilſt I was hoeing my wheat, my plough being then at work, and the earth in a very looſe ſtate, that every time the alleys were ſtirred, they were thrown into a different form: for it is neceſſary ſometimes to make a deep furrow in the middle of the alleys, and at other times to raiſe a ridge in them; and yet, in whatever form the alleys were to be, I had only my plough to perform theſe different operations. It did not ſeem to me reaſonable to ſuppoſe, that two ſo different works could be done equally well with one and the ſame inſtrument: from whence I concluded, that it was neceſſary to have an inſtrument for each of theſe purpoſes.

" I ſoon found what I wanted. The cultivator with mould-boards opens a large furrow in the middle of the alley, by turning over the earth at the ſame time to both ſides. The plough with two ſhares, on the contrary, at the ſame time takes up the earth on both ſides, and turns it into the furrow, which it fills, and thereby lays the foundation of a new bed.

"These inſtruments have this farther advantage that, without requiring a greater number of cattle, they perform as much work at once going over the ground, as the plough can do in two, and ſometimes three operations. I return to my experiment.

"On the twenty-third of June, the wheat ſuſtained a violent hurricane, which laſted an hour. Several great pear-trees were blown down in my orchards, and many large branches were broke off from other trees.

"On the eighth of July, a ſcorching wind blew, which ſhed a great deal of the ripe corn.

"On the ninth, the wheat was reaped.

"A month after harveſt, it was threſhed.

"This field yielded 1575 pounds of wheat; deducting from which the thirty-four pounds fourteen ounces uſed for ſeed, the neat produce remaining is 1540 pounds two ounces. Conſequently, in 1753, this field produced 533 pounds four ounces more than in 1752, including what was ſaved in the ſeed.

"The grain of this wheat was very large, and ſo clean that it did not want ſifting. It yielded plenty of very fine flour, which made exceeding white and well taſted bread."

EXPERIMENT, No. III.

N. B. *This field is marked with the ſame number in the year* 1752. (p. 141)

“THIS field contains one acre and 16 poles, and was but in poor tilth. It was ſowed on the twenty-fourth of September 1751, with ſeven pounds 14 ounces of wheat, and yielded 441 pounds.

“It was brought into better tilth in 1752, but the beds were not raiſed high enough: I would have given them another plowing, if the rainy ſeaſon had not prevented it. They were ſown on the eighth of September, with 24 pounds 12 ounces of very large grained wheat. The plants were extremely fine before winter, and the rows were well filled. In the ſpring, I found that there were fewer plants than in autumn: inſects had deſtroyed ſeveral of them. I likewiſe imputed the loſs of many to the flatneſs of the beds. The plants acquired freſh vigour after the winter, made ſtrong ſhoots, and branched extremely well. I treated this field in the ſame manner as the former. The plants made nearly the ſame progreſs. They were reaped on the fourteenth of July, and yielded 724 pounds 8 ounces. Thus we ſee that this field yielded 283 pounds 8 ounces more in 1753, than in 1752.

Obſervations on theſe experiments.

“I Obſerved in my former experiments, that, as the mould was not ſufficiently looſened, the fields, which were laid out in beds could not produce ſo plentiful a crop the firſt year, as they would the ſecond or third year, when the earth ſhould be more thoroughly divided. It is evident, that whoever ſhould have given up the new huſbandry, upon the bad ſucceſs of the firſt year, would have deceived himſelf. Theſe experiments plainly ſhew, that the charge of the firſt year is fully recompenſed by the profit of the ſecond, and that this profit will encreaſe from year to year.

" Whoever now tries the new husbandry, may reaſonably expect better crops than mine, even the firſt year; becauſe, 1. They now know how the earth ſhould be prepared: 2. They may be provided with inſtruments, already experienced to anſwer the deſired purpoſe with conveniency and eaſe. The different circumſtances to be attended to, are likewiſe known. From the knowlege I have acquired in theſe matters, I can ſay, that the preſent appearance of the corn, which I have ſowed this year in beds, promiſes a very great crop. I ſhall likewiſe have occaſion, in the courſe of theſe obſervations, to ſhew, that though the firſt crop may ſeem very ſmall, yet it is in fact more profitable than that of lands cultivated in the common way.

" Let us now proceed to the preſent ſtate of the lands cultivated for two years according to the new husbandry, and obſerve what the effects have already been.

" When the corn was ſowed, the beds were in a much looſer ſtate than before, and the ſeed was conſequently covered with a fine mould. It came up better: the roots extended themſelves more eaſily, and increaſed in number, in a ſoil which ſcarcely reſiſted them: the plants were ſtronger, and better able to bear the ſeverity of the winter; and, by a ſmall increaſe of the ſeed, the earth was better filled with plants, and thereby better able to ſuſtain the accidents which had thinned them before. After the winter froſts were over, the mould was in ſo looſe a ſtate, that it looked as if it had been newly plowed; — a very different ſtate from that of land in the common husbandry, which, at this ſeaſon, is hard, compact, and very little fitted to afford an eaſy paſſage to the tender roots of plants. How eaſy too did this render all the ſubſequent culture! The weeds, already greatly diminiſhed, did little damage to the corn; and we may readily conceive that the earth, in this looſe ſtate, was eaſily penetrated by the rains, dews, and moiſture of the atmoſphere.

"The effects were, that the plants grew ſtronger and taller than before; that they branched into a greater number of ſtalks; that the ears were very large and well filled with grain, if we may judge by thoſe which eſcaped the hail: that the wheat was very clean; and laſtly, that the crop was greater than that of the preceding year, though it had been conſiderably diminiſhed by the hail, the hurricane, and the ſcorching wind which made many of the ears ſhed their corn. I tried every poſſible means of aſcertaining the loſs occaſioned by theſe accidents; but in vain. I have therefore given up an uncertain calculation; and can only ſay, that I am ſure the loſs was very great."

ARTICLE II.

Experiments made on lands which had borne a firſt crop; with remarks on theſe experiments.

"WE did not expect that the fields we are now going to ſpeak of, would yield a crop near equal to that of the fields treated of in the foregoing article. We knew, that the mould is never ſufficiently broken and divided the firſt year that a field is laid out in beds. Beſides, during almoſt all the laſt year, the earth was too moiſt to be cultivated properly. The wet mould could not be divided into ſmall particles, nor could it be plowed ſo frequently as to admit of ſowing it ſo early as it ſhould have been,

" But every year will not be ſo unfavourable to this huſbandry: and when there are alternate changes, ſuch as we have had this year, of wet weather and of fair, which will afford time for the different plowings, we may, with ſome certainty, promiſe ourſelves a greater crop; ſince, as we have ſeen, this depends chiefly upon the good or bad ſtate of the earth.

" The whole management of theſe fields having been nearly the ſame as that of the ſecond experiment, it would be needleſs to give a particular detail of it in our account of the other experiments."

EXPERIMENT, No. IV.

THIS field is a very ſtrong good ſoil. In the old huſbandry, great ſtrength was required to plow it, and it was neceſſary to catch the ſeaſons when they were neither too wet nor too dry. It contains 13 acres, 2 roods, and 20 poles. I laid near one half of it out in beds, which, with the alleys, were each about ſix feet wide. Part of theſe beds were ſown on the thirtieth of Auguſt, Conſtant rains hindered the ſowing of the reſt till the twenty-ſixth of September. An hundred and eighty one pounds of wheat were employed in ſowing the whole. What was firſt ſowed, came up well, and the plants were very ſtrong before winter: but in one place, almoſt all of them were deſtroyed by inſects. I ſowed this ſpot a ſecond time. The freſh ſeed was ſcarcely able to riſe before winter, and yielded much leſs than the beds which had not met with the like accident. The wheat of the beds which were ſown on the twenty-ſixth of September, was a long time before it ſprung up; owing to the dryneſs of the earth, which continued almoſt the whole month of October. The froſt in November ſtopt the farther progreſs of the plants. Their produce was much ſhort of what was ſowed firſt; which ſhews ſplainly how eſſentially neceſſary it is to ſow early.

"This wheat muſt of courſe grow very unequally. Some beds were extremely beautiful, others middling, and the reſt very poor: yet, throughout the whole, the ears were very large, and well filled with grain; and the crop would ſtill have been a good one, had it not ſuffered by the hail which fell on the third of June, and by the other accidents mentioned in the ſecond experiment.

"The wheat, being perfectly ripe, was reaped on the 13th and 17th of July. It was threſhed two months after, and the whole produce of this half of the field was 3370 pounds of very fine and perfectly clean large-grained wheat, which yielded a great deal of flour.

"The other half of this field was ſowed in equally diſtant rows, with the drill-plough, by which means a great deal was ſaved in the ſeed: for only 479 pounds of wheat were employed to ſow this ground, which, in the common way, would have required about 2016 pounds.

"It was ſowed on the 23d, 24th, 26th, 27th and 29th of Auguſt. We could work only a few hours each day, on account of the frequent ſhowers of gain.

"This wheat roſe perfectly well, grew very ſtrong before winter; and was of a deep green colour, which it retained till it began to ripen. The number of ſtalks increaſed in the ſpring. They grew very long, and bore large ears. In ſhort, they promiſed a fine harveſt. But the hail on the 3d of June ſoon changed the face of the field. It cut off a great number of the ears, broke down many ſtalks, and damaged all thoſe ears whoſe ſtalks were ſtrong enough to remain upright. This misfortune was common to all my wheat.

"This wheat, being ripe, was reaped on the 9th, 10th, and 11th of July, in very hot, dry weather. It was threſhed a month after harveſt, and yielded 5386 pounds of excellent grain.

"Here is an experiment made upon a large extent of ground, cultivated two different ways, and divided into two almoſt equal portions, both of which ſuffered the ſame accidents as equally as could be, according to the beſt of my judgment. This experiment offers us a very intereſting inſtruction.

"The deſign of our experiments is, to know which of the different methods of huſbandry is moſt uſeful; which will beſt promote the public welfare, be moſt beneficial to the owners of land, and bid faireſt to ſecure their productions.

"Let us now compare the produce of each half of this field. It will convince us of a truth of great conſequence to be known, *viz.* that land will produce much more corn when cultivated in beds according to the new huſbandry, than when it is only ſowed in equally diſtant rows with the drill-plough; though this laſt method is indiſputably better than the old huſbandry.

We have ſeen that the part of this field which was ſowed in equally diſtant rows with the drill-plough, produced 5386 pounds of wheat. If it is continued to be cultivated in the ſame manner, it will be in fallow in 1754, and yield no produce: and thus it will bring a crop only every other year.

"The other part of this field, which we formed into beds, produced 3370 pounds of wheat, and is already ſown again for a crop to be reaped in 1754. Suppoſing this crop to be only equal to that of 1753, the produce of the two years will be 6740 pounds of wheat. Hence it is evident, that, in two years, the produce of the beds will be 1354 pounds more than that of the rows. This difference is very conſiderable: and if we would ſee it in a yet ſtronger light, let us extend the ſame calculation to a longer time; for example, to ten years, during which the part ſowed in rows will yield only five crops, which, at 5386 pounds a crop, will amount in all to 26930 lb.

" The part ſowed in beds will yield ten crops, which, at 3370 pounds a crop, make 33700 lb.

" The difference in favour of the beds will therefore be, in ten years, 6770 lb.

" We here ſuppoſe the ſeaſons to be, in every reſpect, like the year 1753. But as our obſervations have conſtantly ſhewn that the crops are always greater after the firſt year, which is likewiſe juſtified by the firſt, ſecond, and third experiments, we may even now venture to pronounce, that the part of our field, which is ſowed in beds, in order to be reaped in the year 1754, and which now makes a promiſing appearance, will yield double the quantity it did in 1753. The profit will therefore be much more conſiderable than we have made it in the above calculation.

EXPERIMENT, No. V.

" THIS field is of a very ſtiff ſoil. It contains 5 acres and 8 poles, and lies ſloping towards the weſt. The beds were well formed, but the earth could not be ſufficiently broken nor could it be ſown early enough, on account of the frequent rains. It was ſowed on the 8th and 25th of September, with 139 pounds of wheat. The corn came up well, and made a fine appearance before winter. It throve well during the ſpring, and when ripe, I cut it down, *viz.* on the 14th and 28th of July, and the crop yielded 2205 pounds of very fine wheat."

EXPERIMENT, No. VI.

"THIS field was reaped in 1752, and immediately formed into beds, with a deſign to ſow it that ſame year. I could not expect that land in ſo bad tilth would produce much. My only aim then was, to form it into beds a year the ſooner. It contained 1 acre, 2 roods, and 15 poles, and was ſowed with 45 pounds of wheat, which yielded 724 pounds."

EXPERIMENT, No. VII.

"MY deſire to practiſe the new huſbandry upon all my lands, as ſoon as poſſible, made me plow another field, which had likewiſe been reaped in 1752. I could however lay only a part of it out in beds: the reſt was ſowed in equally diſtant rows with the drill-plough. This field could have but one plowing: nor could that be completed, though ſeveral ploughs were employed till the 15th, 17th, and 18th of November. The earth was ſo moiſt, that it divided only into large clods. However, I ſowed it ſoon after plowing, not expecting a great crop *. The extent of this field is about 6 acres, 3 roods, and 6 poles. It was ſowed with 412 pounds of wheat, of which only a ſmall part roſe before winter. The number of plants increaſed greatly in the ſpring: they could not branch ſo much as thoſe of the foregoing experiments, and the grain beginning to look a little ſhrivelled, I reaped it on the 21ſt, 23d, and 24th of July. Though this wheat had ſuffered the ſame accidents as the other, yet it yielded 2646 pounds †.

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* If, ſays Mr. Duhamel, Mr. De Chateauvieux had continued to plow his lands, in order to ſow them with ſpring wheat,

ARTICLE III.

Experiments made on lands laid out in beds, and of which the firſt crop was reaped in 1753; *with reflections on theſe experiments.*

" IN our journal of 1752, (p. 153) we mentioned a perſon's having ſowed at leaſt twenty-eight acres in beds. Though theſe experiments did not anſwer well, we have thought proper to mention them, in order to ſhew the cauſes to which their want of ſucceſs ought to be imputed. They will ſerve to inſtruct us in ſome practices which are more neceſſary than might otherwiſe be imagined, and will fix our attention to circumſtances which ought not to be neglected by any one who deſires to make the moſt of his ground."

EXPERIMENT, No. VIII.

" THESE twenty-eight acres were laid out in beds about ſix feet wide. The ſoil is ſtrong, and apt to grow very hard. Three rows were ſown in each bed.

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wheat, he would have begun the new huſbandry with a crop almoſt as good as that of winter wheat.

† We ſee, from this experiment, that a diminution of tillage greatly leſſens the crop.

"Only 460 pounds of wheat were uſed to ſow this field, which yielded but 3150 pounds of very clean grain.

"This is a very ſmall crop. Let us ſee to what it was owing.

"1. This land was very badly plowed: it could only be divided into great clods, incapable of ſupplying the wants of the plants, and of letting them imbibe the nouriſhment neceſſary for their growth. That the bad ſtate of the land was the chief cauſe of the ſmuttineſs of this crop, appears from this circumſtance; that, in ſome ſmall parts of the ſame field, where the mould was better divided, the wheat was finer, branched tolerably well, and produced a greater number of flouriſhing plants.

"2. This field was ſowed too late, viz. not till the laſt week in November. Only part of the ſeeds ſprung up before winter; and theſe plants, not riſing in a good ſeaſon, could not make the progreſs that might have been expected.

"3. Too little ſeed was ſowed. It was the the more neceſſary to ſow a larger quantity, as numbers of grains cannot ſhoot at all in ground badly prepared, and many of thoſe which do ſhoot, are ſo buried under the great clods, that they are not able to riſe. This field was therefore not ſufficiently ſtocked with plants.

"Laſtly, the hail mentioned before, greatly diminiſhed the crop *; which, independent of that accident, would not have been plentiful.

"The owner of this field, after remarking theſe bad conſequences ariſing from the defect of culture, has endeavoured to remedy them, by giving, after harveſt, ſeveral plowings, which have broken and divided the earth more thoroughly

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† It is thought to have deſtroyed above half of it.

roughly, and prepared the beds for being ſowed in good time: the quantity of ſeed has likewiſe been increaſed; the plants have had time to get ſtrength before winter, and their preſent ſtate promiſes that the next crop will be better. Far from being diſcouraged by the bad ſucceſs of a firſt trial, the perſon we are ſpeaking of, convinced of the excellence of the new huſbandry, is but the more reſolved to purſue it. He juſtly aſcribes the ſcantineſs of this crop, not to any defect in the principles of the new huſbandry, but ſolely to its having been badly executed the firſt year. He ſoon perceived that theſe faults might eaſily be remedied, the ſecond year; and therefore has not only continued to cultivate and ſow the ſame field, but has likewiſe ſowed at leaſt twenty-five acres more, laid out in beds, which have been much better plowed than thoſe of the laſt year: every circumſtance of the new culture has been duly attended to, and the corn, even now, promiſes a more plentiful return."

EXPERIMENT, No. IX.

"SMALL experiments have led to much greater. As thoſe ſmall ones are neceſſary at firſt, not only to create a confidence in the new huſbandry, but likewiſe to accuſtom people to the practices which it requires, I ſhall relate one of this kind, made by a perſon who has adopted the new huſbandry from principle, and who is every way qualified to inſtruct us, and to execute well what he has once conceived to be right.

"A piece of ground 270 feet long, and 27 feet wide, was made into ſix beds, to be ſowed with only two rows. This ſpot could not be prepared till the firſt week in September, nor ſowed till the 24th of October. The earth was very dry, and the wheat roſe unequally, and made little progreſs before winter. By a negligence in the firſt hoeing, almoſt whole rows of the plants were torn up. In proportion to what was reaped, this little ſpot would have yielded 180 pounds of very fine wheat.

" A meaſure of oats which was ſowed in beds in a proper ſeaſon, yielded an hundred and twelve meaſures.

" Encouraged by this ſucceſs, the ſame perſon intends to practiſe the new husbandry in a larger way. He has already formed about ten acres into beds, which are now ſown: and he will continue in 1755, and the following years, to lay out twelve acres a year in beds, till he has diſpoſed all his lands in that manner.

" Another thing intended by this experiment, was, to know whether two rows would not produce a larger crop, in proportion, than three. The ſucceſs of this promiſes very fair; but it will be right to continue trying it, and likewiſe to ſee what multiplying the rows will do. We ſhall ſpeak of this hereafter, in order to determine, by real products, what number of rows will beſt ſuit this husbandry."

ARTICLE IV.

Experiments made on fields ſowed in equally diſtant rows with the drill-plough, by ſeveral lovers of agriculture; as related by M. de Chateauvieux.

EXPERIMENT, No. X.

" THIS, and the following experiment, were made by the ſame perſon who made the ſeventh, mentioned in our journal of 1752, (p. 145,) the reſult of which encouraged him to proceed to larger trials, and to prove the advantages of this huſbandry, by new examples. To be more exact in theſe experiments, he reſolved to try the old and the new huſbandry in the ſame field.

"For this purpoſe he choſe a field, the ſoil of which is reckoned equally good in every part. It's whole extent is five acres, two roods, and fifteen poles, ſquare meaſures. Of this, two acres, three roods, and fifteen poles, were deſtined to be ſown in the old way; and two acres, and three roods, to be ſown in equally diſtant rows with the drill-plough. The whole field was equally plowed and dunged, and ſowed on the ſame day, *viz.* the 19th of September, with the ſame wheat. In ſhort, there was no other difference than in the quantity of ſeed, and the manner of ſowing it.

"The part of this field which was ſowed in the old way took up 698 pounds 10 ounces of wheat, which produced 2969 pounds of very fine grain. This is about four and a quarter for one.

"The other part of the field was ſowed with the drill-plough, with 243 pounds, which yielded 3187 pounds two ounces of very fine large grain'd wheat. The proportion here is as thirteen to one.

"We find in favour of the drill-huſbandry; firſt, that, though the ſurface of this ground was fifteen poles leſs than that of the other, yet it produced 208 pounds two ounces of wheat more: and, ſecondly, that, deducting the ſeed of each crop, this neat produce is ſtill more conſiderable, as appears by the following account.

Produce of the part ſowed in the common way - - - -	2969lb.
To be deducted for the ſeed - - - -	698lb.
Remains - - -	2271lb.

Produce

	lb.	oz.
Produce of the part ſowed with the drill-plough - - -	3187	2
To be deducted for the ſeed - - -	243	
Remains - - - -	2944	2

"Which is 663 pounds two ounces more than the produce of the old husbandry.

"The whole field was ſomewhat damaged by the hail on the third of June, which leſſened both the crops a little."

EXPERIMENT, No. XI.

"ANOTHER field, the ſoil of which is better than that of the former, having been well plowed, was ſowed in equally diſtant rows, with the drill-plough, on the tenth of October. It contains one acre, three roods, ſeven poles, and two yards of ground, was not dunged, and was ſowed with 121 pounds eight ounces of wheat, which yielded 2979 pounds of very fine clean corn; which is 24 for 1.

"This return is very conſiderable, and greatly ſurpaſſes that of the foregoing experiment. It ſhould be remembered, that the ſurface of this field is leſs. It did not, indeed, receive any damage from the hail.

EXPERIMENT, No. XII.

"WE mentioned in the journal of 1752, (p. 153) a perſon's having ſown about 150 acres in equally diſtant rows, with the drill-plough; and we obſerved, that a great part of the ground could not be well plowed, and that the whole of it could not be ſowed till November and December. Theſe two circumſtances gave no room to hope for much ſucceſs. About 40 acres, which were the laſt ſown, were dunged: but theſe yielded the leaſt crop of any.

"This great extent of ground was ſowed with 9932 pounds of wheat. To have ſown it all in the common way, would have required 29524 pounds of wheat. Conſequently here is a ſaving of 19592 pounds of wheat, in the ſeed.

"The ſoil of theſe fields being of different qualities, their produce was proportioned thereto, varying from exceeding good to very bad. The 150 acres yielded in all 86058 pounds of wheat. The crop would have been more conſiderable, if about 30 acres had not been greatly damaged by hail. The loſs which it occaſioned, ſhews plainly the great probability of having larger returns in other years, when we become more perfect in the practice of the new huſbandry, to the want of which the bad ſucceſs of this firſt trial has certainly been owing in a great meaſure. All the lands of this farm are now ſowed again with the drill plough. They conſiſt of about 200 acres, and afford a pleaſing proſpect for the enſuing harveſt."

EXPERIMENT, No. XIII.

"A FIELD of four acres, was ſowed in the middle of October with 243 pounds of wheat. It uſed generally to require about 850 pounds. It yielded 2268 pounds. *This*, adds the perſon who has ſent me this account, *is as much as I have had from any other field ſown in the old way.*"

EXPERIMENT, No. XIV.

"THE ſame perſon who made the foregoing experiment, ſowed another field of about four acres and a half, of a poorer and colder ſoil, towards the middle of November, with 333 pounds of wheat. In the old way, it uſed to be ſowed with 972 pounds. It yielded 1260 pounds. The corn in this field remained thin. It did not branch ſo well as that of the former. The perſon who ſends me this account of theſe two experiments, adds: " It muſt be obſerved, that the " drought, as well of the autumn as of the ſpring, " was unfavourable, eſpecially to the late ſown " wheat. Theſe experiments have encouraged " me to purchaſe a drill-plough, and to ſow all my " lands with it in equally diſtant rows, according " to the new method, this year 1753: only I " have obſerved to ſow earlier, *viz.* between the " middle of Auguſt and the middle of September; " and thicker, that is to ſay, 45 pounds, on the " ſame extent of ground where I ſowed but 34 " pounds and an half, and 41 pounds and an half " in 1752. My plants, hitherto, make a fine appearance, and are very thick: their blades are " large, and the whole is in great vigour."

EXPERIMENT, No. XV,

By M. de Chateauvieux.

" I Have extended my experiments to an eſtate where I have not time to make any long ſtay myſelf, ſo that what is done there is left to the diſcretion of ſervants, whoſe eye, as is well known, is not like that of the maſter.

" The lands of this place are very poor: they produce but little corn, though that little is exceeding good. In 1752, they were very badly plowed, and this plowing was ſpoilt by heavy rains, juſt as we were going to ſow. I ordered the whole to be ſowed with the drill-plough, except two acres, which were ſown in the old way. Some

few

few fields were a little better plowed than the reſt. Theſe produced pretty good wheat. The others were very poor. However, I have reaſon to be pleaſed with my having ſowed in this manner. I judge of it by the produce of the two acres which were ſown in the common way, and which yielded me no more than exactly the quantity of the ſeed beſtowed upon them.

"The true cauſe of this was the bad condition of the lands. They are in much better tilth this year. All of them have been ſown with the drill-plough, in a favourable ſeaſon, and my ſervants aſſure me that the corn riſes finely."

ARTICLE V.

M. De Chateauvieux's *account of the crops produced during ſixteen ſucceſſive years, by fields cultivated and ſown in the common way, and of which part was conſtantly dunged; compared with a crop of the ſame fields cultivated without dung, according to the new husbandry, even ſuppoſing them not to yield more than they did in* 1753, *which was their firſt crop, and which was greatly diminiſhed by the unforeſeen and extraordinary accidents already mentioned.*

"THE reſult of our experiments would be of little uſe, if it extended no farther than our own private inſtruction. To render it of more general ſervice, we ſhall here give a compariſon of the produce of lands cultivated according to the old huſbandry, and according to the new, that every one may judge which of the two is moſt likely to anſwer beſt.

"This parallel will ſhew how much the new huſbandry is ſuperior in point of advantage, to the old. We are to ſuppoſe all the circumſtances of the ſeaſons to be like thoſe of the years of which we have compared the products. But as the expence of culture is an object well worth conſidering, and as that expence may not be equal in both ways, I beg leave to lay down here as a fact, "That the charge of the new culture is leſs than that of the old." I have tried it, and find it ſo; as I ſhall, hereafter, prove beyond diſpute.

"By the old culture, in the farm which I now cultivate in the new way, I ſhould have had but two fields ſown in 1752; to be reaped in 1753, *viz.* that of the experiment No. IV. and that of the experiment No. V. Theſe two fields contain together eighteen acres, two roods, and twenty-eight poles. I have calculated their produce during ſixteen years, *viz.* from 1730, to 1745 incluſively. They have yielded, in that time, eight crops, the total produce of which has been 146863 pounds of wheat: deducting from which, 42130 pounds for the ſeed ſown in the eight years, the neat produce will be reduced to 104733 pounds*.

"It is proper to obſerve, that this wheat was meaſured every year in the barn, as ſoon as it was threſhed, and before it was ſifted: an operation which always occaſions a conſiderable diminution, though we do not make any allowance for it here.

"Let us now ſee what crops the preceding experiments give us room reaſonably to expect from the ſame two fields in ſixteen ſucceſſive years of the new huſbandry; to judge only by that of this firſt year 1753, unfavourable as it is.

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* The fields which were ſown alternately during the eight other years, though their extent was ſomewhat larger, yielded ſtill leſs grain. Their whole produce was but 114331 pounds.

" The field, No. IV. was ſowed, half in beds, and half in equally diſtant rows. I am obliged to ſuppoſe it to have been ſowed entirely in beds; for it cannot be doubted but that the part which was ſowed in rows, would have produced as much as the other: conſequently the whole crop of the two halves, at 3370 pounds each, would have been 6740 pounds.

" As the ſame fields yield a crop every year, in the new husbandry, we ſhall have ſixteen crops inſtead of eight: ſo that, multiplying the firſt year's crop, 6740 pounds, by ſixteen, the total produce will be 107840 pounds; to which muſt be added that of the experiment No. V, which was 2205 pounds; which being alſo multiplied by ſixteen, will produce a farther quantity of 35280 pounds for the ſixteen crops. This, added to the amount of the experiment No. IV, will make in all 143120 pounds of wheat for the ſixteen years.

" If we afterwards deduct from this, the quantity of ſeed uſed in theſe two fields during the ſixteen years, which amounts to 8016 pounds, the neat produce will be	135104 lb.
" In the old way, the ſame fields would produce, in ſixteen years, only	104733 lb.
" The difference in favour of the new culture is therefore	30371 lb.

" Beſides the advantage of reaping a much greater quantity of corn, there are others which highly merit our attention. This corn is not mixed with any ſeeds of weeds, and its quality is greatly improved by the abundance of nouriſhment which the plants are ſupplied with by the frequent ſtirrings of the earth in this husbandry, more than in the old.

"But how fine a proſpect does the propoſition which we advanced before, afford us beyond all this! *viz.* "That the crops of the ſecond and "following years, would be ſtill more plentiful "than the firſt." What ſome might then think only an object of hope and ſpeculation, is already realized, and proved by experience. All this deſerves the moſt ſerious attention. The new husbandry will certainly, in time, acquire a ſuperiority over the old, greater than we can now imagine."

ARTICLE VI.

Proofs that the beſt field in the country, though the greateſt part of it was dunged, yielded leſs wheat than thoſe of the experiments No. II. *and* XI, *in which no dung was uſed. By* M. de Chateauvieux.

"THE proofs of the advantages of the new husbandry cannot be too greatly multiplied; and all thoſe which are the reſult of experience, deſerve to be communicated to the public.

"The field we are going to ſpeak of, is generally, and juſtly, reckoned the beſt in the country. It's ſoil is excellent, very deep, and extremely fertile. This field is dunged very often. It's nearneſs to the farm-yards renders the carriage of manure extremely eaſy, and is the cauſe of it's getting perhaps more of it than may be neceſſary. It's ſituation too is excellent, riſing on all ſides above the neighbouring grounds, and the highways which ſurround it; by which means it is leſs expoſed to be hurt by wet, the water finding an eaſy drain from off it.

" The extent of this field is 6087 fathoms* (4 acres and 8 poles.) It was ſowed in 1752, for the harveſt of 1753, and the greateſt part of it was well dunged.

" It is not the cuſtom of the place I am ſpeaking of, to deſcribe the extent of a field by the number of acres contained in it, but by the number of meaſures of wheat with which it is ſowed. Eight meaſures uſed generally to be employed to ſow this: but the quantity of ſeed was leſſened this laſt time, and only ſeven meaſures were ſown. We have hitherto ſuppoſed the ſurface of this field to be equal to that of the other fields of the ſame country, in which eight meaſures of ſeed are ſown.

" But as I was deſirous to be more preciſely exact, in order to form the compariſon I purpoſed making, I had recourſe to the geometrical plans of the lands, and found the contents of this field to be, as I ſaid before, 6087 fathoms: now, the cuſtom of the village to which it belongs is always to ſow at leaſt eleven meaſures in a ſpace like this. One field, among others, very near to this, and which is but 24 fathoms and 32 feet larger, has always been ſown with twelve meaſures.

" A new cauſe of the fruitleſsneſs of this field, unknown before my obſervations, is, that the farmer wiſely took care to ſow it with a leſs quantity of ſeed. The plants throve better, when the land was not over-ſtocked with them. This field will therefore help to prove the truth of one of the

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* Though this word is moſt commonly applied to the depth of the ſea, I uſe it here, as a meaſure of length containing ſix feet; and therefore exactly equal to the French *toiſe*, by which M. de Chateauvieux, M. Duhamel, and their correſpondents generally reckon: but, in other parts of this work, I have, reduced thoſe *toiſes* to the ſtandard of the Engliſh acre, rood, &c.

firſt

firſt principles of the new huſbandry, *viz. that the quantity of ſeed generally uſed ought to be diminiſhed:* a propoſition which deſerves our entire confidence, becauſe the ſeed here has, from time immemorial, been reduced to eight meaſures, and they have been ſufficient to produce very plentiful crops. The farther reduction made in 1752, to ſeven meaſures, muſt alſo be approved of, ſince the crop which theſe yielded was very fine.

" Theſe preliminary obſervations ſeemed neceſſary, before we proceeded in our detail. This field was ſowed with about 850 pounds of wheat. It was finer during the whole ſummer, than any wheat in the common way. It was reaped at a proper time, and yielded about 6646 pounds; from which muſt be deducted, firſt, the 850 pounds of ſeed, and ſecondly, the value of the dung, which is equal, at leaſt, to 1260 pounds of wheat; together 2110 pounds; which, deducted from 6646 pounds, the total produce, leave for the neat produce 4536 pounds.

" The crop of 1753 was diminiſhed by the hail on the third of June. The value of this loſs is not known: but we may fairly compare it with the experiment, No. 2. which likewiſe ſuffered by the ſame hail. We confeſs that this compariſon is not abſolutely exact, with reſpect to this accident: but it muſt alſo be granted, that this circumſtance cannot occaſion any very great error. We muſt likewiſe premiſe, that we ſhall not reckon the produce of a ſmall ſpot which is pretty commonly ſowed in March in the year of fallow, becauſe it hardly equals the expence of dung and plowing.

" The neat produce of the experiment No. 11, on a field ſowed in equally diſtant rows, was 2857 pounds 8 ounces. But the extent of that field being only 1 acre, 3 roods, 7 poles, and 2 yards, we muſt calculate what the crop would have been, in proportion, if that extent had been 4 acres and 8 poles (6087 fathoms,) ſuppoſing it of the ſame quality, We ſhall find that the field on which our experiment was made, would have produred neat 8006 pounds of wheat: deducting from which, 4536 pounds, for the neat produce of the field cultivated in the old way, the difference in favour of the new husbandry, without dung, will be 3470 pounds of wheat.

" We have ſeen by the experiment No. 2. that this field laid out in beds, and having borne its ſecond caop, yielded neat 1540 pounds of wheat. Its extent is but 1 acre, 1 rood, and 18 poles; ſo that we are to ſee what crop it would have yielded if its extent had been 4 acres and 8 poles; ſuppoſing the quality of the ſoil to be the ſame. The rule of three ſhews us again, that its neat produce would have been 5681 pounds of wheat, which we are to double for the amount of the next year's crop; every year yielding a crop in the new huſbandry: whereas the field it is compared with, would lie fallow this year· Thus two years will yield 11362 pounds of wheat; from which deducting 4536 pounds for the neat produce of the ſame field cultivated in the old way during the ſame ſpace of time, the difference will be 6826 pounds of wheat, in favour of the new huſbandry.

ARTICLE VII.

Reflections and obſervations on the practice of the new huſbandry; *by* M. de Chateavieux.

" THE chief object of our reflections laſt year was, the effect which plowing and culture have upon plants. They ſeem to us to be confirmed by the following obſervations.

" 1. The productions were greateſt in thoſe places where the earth had been moſt looſened and brought to the fineſt tilth.

" 2. We have ſeen plainly, that, in order to improve our tillage, it is neceſſary to make the great furrow in the middle of the alleys very deep becauſe that furrow being afterwards filled up, and a new bed made over it, there is a greater depth of light well looſened mould immediately under the roots of the plants.

" 3. We can affirm, that we have this year, without much trouble, plowed our beds from fifteen to eighteen inches deep, which is very conſiderable: but we muſt not flatter ourſelves, that this depth can always be attained the firſt year: it is by continuing this ſame culture that we ſhall inſenſibly reach it.

" 4. To have great ſucceſs, requires proper care and judgment in performing every part of the new husbandry. The culture which is well executed, will be of very great uſe; but that, on the contrary, which is badly done, will be of no ſervice to the plants, and may even prove very detrimental to the next year's crop.

" 5. To perform this culture with advantage, it is therefore neceſſary to obſerve this important maxim of tillage, ſo little attended to by many farmers, *never to ſet the plough to work, when the earth is too moiſt.* I have adhered to it ſtrictly, and have never ſuffered my lands to be touched till they were dry. We have tilled when the weather has been very dry and very hot, and then it was that our culture had the beſt effect: the ſtiffeſt land, having been broken by the preceding plowings, was provided with the moiſture neceſſary for plants, from its ſurface to the bottom of the furrows; and the plants were ſenſibly benefited by all our frequent ſtirrings.

" 6. I was ſo ſtruck with this, that I marked ſeveral ſtalks, to ſee how much they grew each day. From the time that the ears began to appear till they had done bloſſoming, I found that they grew an inch in four and twenty hours. The hotteſt days were thoſe in which the ſtalks grew moſt; whilſt all vegetation ſeemed almoſt ſuſpended in the wheat in the common way.

" 7. This obſervation led me to another. I was greatly ſurpriſed one day to find my ſtalks juſt as I had left them the day before. The next day, and the day after, I found them ſtill the ſame: in ſhort, they grew no longer from that time.

" So ſudden a change raiſed my curioſity greatly, and I reſolved to find out the cauſe of it. The time when they ceaſed to grow, was immediately after they had done bloſſoming. I judged that, from that time, all he ſap was conveyed to the ear, to form the grains, and that the reſt of the plant had only what was neceſſary to prevent its drying too ſoon. This diſpenſation of the nutritive juices ſeemed to me very remarkable: all their forces ſeem then to unite, in order to form, fill, and ripen the grain, which is the moſt uſeful part: I was afterwards confirmed in this, by obſerving that it was from that very time that the ſtalks and blades began inſenſibly to loſe their deep green colour, and that this green grew lighter and lighter every day: a ſure ſign of a diminution of ſap in thoſe parts.

" 8. It is likewiſe of very great importance to know which is the moſt proper time for ſowing; for the growth of plants depends greatly on this circumſtance. Late ſowings have not anſwered: but the early ones have produced plants, whoſe vigour has enabled them the better to reſiſt the winters cold, and to branch out the more abundantly. By attending to this circumſtance, the farmer will enjoy the deſirable advantage of having his corn ripen early, and of it's being leſs expoſed to the dangers of the ſummer ſeaſon : for we have ſeen that the wheat which was ſowed firſt in the new method, ripened thoroughly as ſoon as that which was ſowed in the old way. It is proper to know this, in order to be ſenſible of the neceſſity of beginning to plow early, that the ſeed may be ſowed in due time.

"9. I muſt beg leave again to make a few reflections relative to the quantity of ſeed moſt proper to be ſown. It is of the utmoſt importance to know how to proportion the quantity of the ſeed to the ſtrength and richneſs of the ſoil, ſo that each may have it's due proportion. The experiments already made, help to direct us ; but I think others ſtill neceſſary, before we can truſt abſolutely to our knowledge in this point.

"At preſent, I ſhall only adviſe ſowing the ſame quantity of ſeed as I did in 1752: I fancy that proportion will not differ greatly from what a longer practice will ſhew to be beſt. However, the ſame quantity of ſeed will not do for every ſoil. It muſt be varied with judgement, and regulated according to the circumſtances of the ſeaſon, and the better or worſe condition of the land. I think too, that, in the firſt, and even the ſecond year of the trials which may be made, it will be propor to ſow a little thicker than I did in 1752: The farmer will eaſily perceive, that when his lands are well looſened and brought to a good tilth, they will require leſs ſeed: but till then, he will do well not to be over ſparing of it.

"10. We cannot yet determine ſo exactly as we could wiſh, what breadth the beds, including the alleys, ſhould be of, to make the ground produce the greateſt quantity of corn ; nor whether it would be beſt to ſow more or leſs than three rows.

We confeſs that we ſhould be glad to ſee a longer ſeries of accurate experiments, and to have a greater knowledge of this matter, before we pretend to fix it: Our beds have always been about ſix feet wide.

" M. Duhamel, who firſt introduced this new huſbandry in France, intends to make experiments by ſowing only two rows. If they ſhould yield more grain, the breadth of the beds may certainly be diminiſhed: and as it is of conſequence to multiply and vary experiments, in order to determine this point, we now have ſeveral beds ſown, ſome in two, and ſome in three rows. I have likewiſe tried what multiplying the number of rows in ſome fields would do; and the reſult of this experiment promiſes an advantage in that way of ſowing. The ſucceſs of this firſt trial was as follows.

" When the field of the experiment No. 2, was ſowed, I obſerved, among the reſt, ten beds which the plowman had made wider than the others. I was ſorry, at firſt, that any part of the ground ſhould be loſt: but, upon ſecond thoughts, I determined to ſow thoſe beds with two turns of the drill-plough; and conſequently to plant them with ſix rows of wheat. I did ſo; and when the firſt plowing after winter was given, little regard was paid to the two outſide rows, which were torn up by the plough in ſeveral parts; ſo that there remained but four or five rows in thoſe places.

" The wheat of theſe beds, not excepting even the middle rows, grew as high, and branched as much, as that of the others, in which there were but three rows. I examined them frequently with great care, and was aſſiſted therein by ſeveral perſons very capable of judging and making good obſervations, The only difference we could diſtinguiſh, *and that was ſcarcely perceptible*, was in the ears, which we thought rather ſhorter in the middle rows than in the others: but as there was a greater quantity of them, we judged that theſe beds would yield the moſt grain.

“ We were not miſtaken; for their produce was as follows. The ten beds, ſown with ſix rows each, yielded 91 pounds of wheat more than ten beds ſown with three rows each. But, as this reſult does not ſet the matter in a ſufficiently clear light, we muſt have recourſe to the following calculation. The ſix rowed beds took up more ground than thoſe which had but three rows: two beds more might have been made out of the ſurplus of their breadth: ſo that there would in that caſe have been 12 beds inſtead of 10. The queſtion therefore is, whether this ground, made into ten beds, produced more than it would have done if it had been made into 12 beds of three rows each. To which I anſwer, that it did produce 38 pounds more; and that there was likewiſe a ſeventh part more ſtraw.

“ As this experiment deſerved to be repeated, I have tried it in a larger way. I have laid ſeveral acres out in beds of about ſeven feet wide: they are ſown with ſix rows: the plants are very fine, and I impatiently wait the event,

“ Though I have continued not to dung my fields, the plants ſtill grow very tall, and produce fine long ears, well filled with plump grain.

“ I am indebted to the new husbandry for the recovery and improvement of worn-out meadows. They have already yielded me plenty of fodder, the value of which ought to be added to the produce of the fields, becauſe the new husbandry is the immediate cauſe that manure can be ſpared to enrich thoſe meadows.

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ARTICLE VIII.

General diſpoſition of the lands for the crop of 1754.

"THE more I have ſtudied the principles of the new huſbandry, the more I have been convinced of the advantages attending it. My experiments have not only confirmed me in this opinion; but they have likewiſe ſhewed me, that my practice has been conſiſtent with thoſe principles. This made me determine to lay the whole of one of my farms out in the new way, as ſoon as I poſſibly could; it's extent being no more than I can direct almoſt the whole culture of myſelf.

"I have completed it this year. All the fields, of which only half uſed to be ſowed every year in our old way, are now laid out in beds. I have ſowed them all, with a deſign to continue doing ſo for the future every year. They look exceeding well hitherto: the plants are extremely fine, and promiſe a greater crop next year, than that of the experiments of the foregoing years.

"Theſe experiments have likewiſe made a ſtrong impreſſion on ſeveral perſons in this country, each of whom judged of the new huſbandry, as his inclination, or proſpect of advantage, directed. It is true, our farmers are more generally inclined to ſow their lands in equally diſtant rows, with the drill-plough, than to lay them out in beds; the proper management of which, ſay they, is attended with much more care and trouble. My drill-plough is preferred on account of it's ſimplicity. It began to be uſed laſt year, and numbers of fields near this city (Geneva) have been ſowed with it this year.

"Several of our peaſants have likewiſe tried the drill-plough, and their example will be of conſequence hereafter. Their unwillingneſs to come into any new practice is well known: but this ſeems to get the better of their prejudices; and the proſpect they now have of greater crops than uſual, makes them regret their not having ſowed a larger extent of ground in this manner.

"We have about an hundred and fifty acres ſowed in beds, and alſo near a thouſand ſowed in equally diſtant rows. Such large experiments, and made on different ſoils, cannot but afford new inſtruction: the facts will be better aſcertained, and people will be more thoroughly convinced that the greater product of the crops is owing to the new husbandry, and not to favourable circumſtances, to which they are too apt to impute it. Theſe experiments, ſay they, have been made on the very beſt ſoils; it is much eaſier to prepare two or three roods of ground, than an extent of ſeveral acres; theſe little ſpots have been cultivated with vaſt care; it is almoſt impoſſible to beſtow the ſame attention upon large tracts of land.——Luckily, ſeveral lovers of agriculture are making large experiments, which already prove, that the new husbandry may eaſily be practiſed in any extent of ground whatever."

CONCLUSION.

"ANY one may now judge, by the experiments which have been made theſe laſt four years, and by the ſucceſs which has attended them, how far the principles of the new husbandry are juſtly founded, and how far we are in the right road to give ſtill farther demonſtrations of it's excellence.

"The lands on which it has been already practiſed, leave no room to doubt that all it's operations may be performed with eaſe: and at the ſame time they prove to thoſe who ſhall be inclined to cultivate any part of their farms in the ſame way, that they may do it with equal advantage.

"Convenient inſtruments for executing this culture are already invented and made. The uſe which has been, and ſtill is made of them, ought to increaſe our confidence in them. It is by their means that the two moſt eſſential articles towards ſecuring ſucceſs, are obtained: the firſt is, the means of forming, plowing, and cultivating the beds, with great eaſe and little expence: the ſecond, that of ſowing land more regularly, and of giving it the exact quantity of ſeed that may be thought moſt proper, by means of the drill-plough, which buries the ſeed at it's proper depth in the furrows, covers it over, and, in ſhort, performs the whole buſineſs of ſowing, with great diſpatch, and a conſiderable ſaving of ſeed.

"The chief obſtacles being now removed, we may reaſonably hope that the new husbandry will gain ground every year. Numbers of intelligent perſons, truly zealous for the public good, have ſeen how my lands were cultivated, and have been curious enough to be preſent at all the operations of this culture. They have frequently told me, that the public have not a right notion either of the new husbandry in general, or of the eaſe with which it is performed. They themſelves have wondered at it, and preſſed me to publiſh a circumſtantial account of the manner in which I have introduced this new method into our country, that they might alſo inſtruct their countrymen therein. I have yielded to their ſollicitations; and ſhall continue to communicate my farther obſervations in this fourth year of my practice of the new huſbandry."

Experiments made by M. Lullin de Chateauvieux, *in the year* 1754[d].

"MY experiments in the year 1754, will afford a freſh proof of what I ſaid in my accounts of thoſe of the preceding years, *viz.* that land, by continuing to be cultivated in the new way, will become more and more fertile, and produce greater crops even in the ſecond or third year, than in the firſt; becauſe the earth will then be in a looſer ſtate, which is highly neceſſary in order to have plentiful productions.

"This proof ought to be received with ſo much the more confidence, as the ſeaſons of the year 1754 were not favourable to the growth of corn. It was an extremely dry year; the earth had not the degree of moiſture which is neceſſary to promote the vegetation of plants; the wheat was in general very thin and low, and numbers of farmers did not reap above half the crop that the ſame lands had yielded them in 1752.

"The wheat ſuffered great accidents early; for it was *ruſted* in October and November. Till then, it was very ſtrong, and promiſed well; but afterwards, it turned yellow on a ſudden. The *ruſt* made a great progreſs. I met with places where the ground was entirely covered with the powder of this diſtemper. The vegetation of the plants before winter, was from that time nearly at a ſtand.

"They were likewiſe hurt, and perhaps ſtill more, by the froſts which began again in March, and laſted till the 20th of that month. Theſe froſts rooted up prodigious numbers of plants of the wheat ſowed in the common way, which withered in a few days. Some fields ſuffered ſo much by this accident, that it became neceſſary to plow them anew, and to ſow them again with oats, or other ſpring corn.

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[d] DUHAMEL, *Culture des Terres, Tom.* IV. p. 271.

" To ſhew the reſult of my experiments more diſtinctly; I ſhall range them in the following order.

" The firſt article will contain an account of three experiments made on lands laid out in beds, and which have borne a third and a fourth ſucceſſive crop; to which I ſhall add ſome remarks particularly relative thereto.

" In the ſecond article, I ſhall relate four experiments which I made on lands formed into beds, which had borne a ſecond crop. Theſe too will be accompanied with ſome reflections.

" The third article will give an account of three experiments made on lands formed into beds, which have borne a firſt crop, and of the manner in which I tilled them, in order to prepare them for ſowing. This will give riſe to ſeveral remarks.

" The fourth article will inform the public of ſome other experiments made on lands laid out in beds, which have yielded a firſt and ſecond crop. This will be followed by ſome intereſting obſervations.

" In the fifth article I ſhall relate ſeveral experiments made by divers lovers of agriculture, on lands ſowed in equally diſtant rows with the drill-plough.

" The ſixth article will contain an account of the produce of ſeveral fields ſowed in equally diſtant rows, with the drill-plough.

" In the ſeventh, I ſhall make ſome general obſervations on the experiments contained in the foregoing articles.

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" I ſhall ſpeak, in the eighth article, of the experiments which I have made on beds ſowed with ſix rows of wheat; and compare their produce with that of others, ſowed with only three rows. The reſult of this will enable us to judge how many rows it may be beſt to ſow.

" In the ninth article, I ſhall give a circumſtantial detail of an experiment which I made in order to be more ſure of *the beſt way of ſowing the beds*; and to be able to determine more exactly, what quantity of ſeed is moſt likely to produce the greateſt crop.

" Before I enter upon either of theſe ſubjects, it will be proper to obſerve, that I have not uſed any dung, or any ſort of manure, for my fields or beds; purpoſely to be the more certain of the effects of this new culture, and to ſee what land could do by mere dint of ſtirring it. My dung has been laid, as uſual, upon my graſs lands, where it continues to be of wonderful advantage.

" I ſhall continue to reckon by the pound of 16 ounces."

ARTICLE I.

Experiments made on lands formed into beds, which have yielded a third and a fourth ſucceſſive crop: with ſome obſervations particularly relative thereto.

EXPERIMENT, No. I.

N. B. *This field is marked with the ſame number in the journals of* 1751, *p.* 125; 1752, *p.* 133; *and* 1753, *p* 155; *and is the ſpot on which I made my firſt experiments in* 1751. *This is the fourth ſucceſſive crop.*

"THE ſmall ſpot of ground on which I made the experiment I am going to ſpeak of, being only a ſingle bed, 160 feet long and five feet wide, would not deſerve to be taken notice of in this account, were it not for a circumſtance extremely remarkable, and the more worthy of our attention, as the ſucceſs it was attended with, affords an unexpected and indiſputable proof of the fruitfulneſs which may be expected from land cultivated in the new way. If farmers will but continue it to the third or fourth year, they will then be ſure of having their ground in excellent tilth, well looſened and divided, and it's pores properly opened and exceedingly multiplied. That this will be the caſe, cannot be doubted. Yet ſome may perhaps be weary of cultivating their lands for ſo long a time, before they attain that perfection of culture, which we have all along declared to be neceſſary, in order to have great ſucceſs.

"To prevent the diſguſt which might ariſe from ſo diſtant an expectation, and to encourage the lovers of the new huſbandry, I ſhall obſerve, in the firſt place, that there are, in every country, conſiderable tracts of good land, which may be brought to a proper tilth in leſs time. I am, however, ſenſible how much the progreſs of the new huſbandry would be promoted by the finding of ſome ſhorter way to break and looſen the earth, in ſoils of an inferior quality: and accordingly I have tried whether this cannot be done.

"I have ſucceeded therein fully to my ſatisfaction; and can now ſay with certainty, that land may be brought to a ſufficiently looſe ſtate, even the firſt year, by plowing it in the manner I ſhall explain in the third article, Experiments 8, 9, and 10, the crops of which were very good.

"The moſt certain and moſt inconteſtable principle of the new husbandry, is, that *the earth muſt be thoroughly looſened by deep and frequent plowings and repeated culture.* In conſequence of this, I examined very carefully whether my lands were more looſened and rendered lighter by my manner of performing the operations of the new husbandry, than they were when cultivated in the common way. All my obſervations convinced me that they were.

"The firſt glance of the eye ſhewed me, that the ſurface of the ground was ſmoother: on ſounding the plowings, I found them deeper; leſs ſtrength was required to plow: two horſes, and ſometimes only one, or a ſingle ox, did with eaſe what would otherwiſe have required at leaſt double that number of cattle. A manifeſt proof that my lands were in excellent tilth.

"If, after having thus examined the lands themſelves, I conſidered their productions, I had a freſh proof of their being brought to that ſtate of pulveriſation, in which alone plants can thrive well. My wheat was infinitely ſtronger than that in the common way; and, upon a minute examination, I found, that each plant had a greater quantity of roots, ſtronger, thicker, and much longer, than other wheat; and that the blades were broader and longer, and of a much deeper green. The plants had generally a great number of very thick and long ſtalks, which were crowned with large ears quite full of grain, and much heavier than thoſe of the wheat raiſed in the common way.

" All theſe obſervations were ſufficient to convince me, that my lands were in the ſtate I wiſhed them to be; that is to ſay, that they were looſened and divided ſo as to be capable of yielding great productions.

" It was therefore leſs to ſatisfy myſelf, than to give the public a farther proof of the excellence of the new husbandry, that I made the experiment I am now going to relate. It is an intereſting one in every reſpect; and I doubt not but that it will induce many others to make the like trial. I can aſſure them that they will find it well worth their while.

" When the harveſt of 1753 was over, I immediately ſet about plowing my fields, and forming the new beds that were to be ſowed. The year was a very dry one. I uſed frequently to walk, both over the beds, and over the fields cultivated in the common way, where the corn had likewiſe been lately cut down.

" The firſt thing that ſtruck me in theſe walks, was, the difference which I found in the ſtubble. That of the fields cultivated in the common way was ſo poor and weak, that it ſcarcely oppoſed the motion of my feet. That of the beds, on the contrary, reſiſted greatly: I often felt it break under my feet, and frequently met with tufts of 20, 30, 40, and ſometimes more ſtalks, which ſtopt me ſhort, like ſo many little buſhes.

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" I am the more particular in my account of this ſtubble, becauſe it ſhews the great ſtrength of the plants; which they would not have had if the earth had been leſs well prepared. Beſides, this ſtubble has it's real uſe, as I ſhall ſhew elſewhere. *It is a much better manure for land, than the common ſtubble.*

" This obſervation led me to examine carefully what other differences I could find between the fields cultivated either way. The moſt important is, the ſtate of compreſſion which thoſe in the common way were in after harveſt. They offered nothing pleaſing or ſatisfactory to the eye; the earth was extremely hard, cloſe, and compact; and it's ſurface almoſt as firm as that of a beaten road.

" The fields in the new way, prepared by better plowings made at proper ſeaſons, were, on the contrary, ſtill very light and ſoft in the middle of the beds, in the intervals between the rows of ſtubble. The earth gave way like ſand, when trod upon; and *though it was very dry*, I thruſt a ſtick of green willow eight or ten inches deep into it, with great eaſe, though I could not by any means puſh it at all into the land which had been cultivated in the common way. This plainly ſhews the better ſtate of the former.

" Laſtly, I compared theſe fields with thoſe that were in fallow, which had been plowed, and were intended to be ſowed in autumn. I found the tops of the late reaped beds, in much better condition, than the common fields which were under fallow. This made me immediately conclude, that theſe very beds might be ſowed again with ſucceſs, in the ſame places where the corn grew the year before, *without plowing them.*

" I thought, however, that, if this trial did ſucceed, it would be owing, in ſome meaſure, to the culture of the alleys, and that this would fully prove their utility. This was another reaſon for my trying the experiment.

"It appears by this, that my chief deſign was to try whether the ſame ground could be ſowed, in the ſame place, two years running, without plowing; and to ſee how ſtrong the plants would, in that caſe, be at harveſt.

"I was conſequently to avoid, in ſowing it, every thing that might ſupply the want of plowing, and to ſtir only juſt ſo much earth as was abſolutely neceſſary in order to bury the ſeed. This conſideration prevented my uſing the drill-plough, the ſhare and harrow of which divide and looſen the earth perfectly well, as deep as the ſeed is planted.

"All that I did to this bed, was, barely to pull up the ſtubble, and afterwards draw a line with a ſtick, as if it had been for ſowing lettice. The ſeed was dropped by hand into three of theſe channels, and afterwards covered with a rake.

"Birds had done great damage to the wheat which I ſowed the year before in this ground. To avoid this accident now, I ſowed a kind of corn called *ſpelt*, which is uſed in many places inſtead of wheat. The Germans cultivate it greatly. The ſpelt which I ſowed is of a ſomewhat different kind. The grain of both ſorts is incloſed in double huſks, very thick, and of which the outer one does not open eaſily; ſo that birds cannot well pick out the grains.

"I ſowed this bed very thick, concluding that the plants would not branch much: and I ſowed it early, *viz.* on the nineteenth of July, becauſe this grain remains a whole year in the ground, from the time of ſowing till it is ripe. I uſed in all eleven ounces of ſeed, which ſoon ſprung up, and the plants made very ſtrong ſhoots; but I thought them too thick.

" As this ground had not been plowed, I thought it was proper to aſſiſt the plants otherwiſe as early as I could. They were weeded on the twenty-ſecond of Auguſt.

" Theſe plants grew ſo extremely thick, that their blades covered the ground four feet round, before winter, in ſuch manner that the earth could not even be ſeen through them. The rows were from a foot to a foot and an half high, and the whole had already ſpindled, which made me ſorry I had ſowed ſo early; fearing leſt plants ſo forward before winter, as theſe were, ſhould be killed by the froſt; and, in order to ſecure ſome reſource in caſe that ſhould happen, I ordered part of the bed to be mowed on the ſixth of November, but did not touch the reſt. I muſt here obſerve by the way, that *the part which was mowed had feweſt ſtalks at harveſt*. At the ſame time I gave the alleys their firſt plowing before winter. Upon opening a furrow near the rows, I ſaw ſuch a prodigious quantity of long roots, interwoven as it were with one another, that I continued to hope well of the ſucceſs.

" Seeing, however, ſo many roots uncovered and expoſed to the air and froſt, I was tempted to fill the furrows up again, in order to preſerve them from it: but conſidering, that by leaving the furrows open, the part of the bed in which the plants were, and which had not been plowed, would be much more expoſed to the froſt, which would then penetrate the earth through it's ſurface, and through both ſides of the furrows, whereby it would be greatly divided, and perhaps meliorated more than by plowing, I preferred leaving the furrows open, and have had no cauſe to repent it.

" I conſidered too, that ſuppoſing theſe roots expoſed to the air ſhould periſh, which was no more than I might reaſonably expect; the plants had other

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other roots on their other ſide, which, ſtill remaining covered with earth, would be ſufficient to ſupſupply them with the neceſſary nouriſhment till ſpring.

" After winter, the plowings were performed in proper weather, and the bed was weeded. I ſhall not repeat the detail of theſe operations, either here or in the following experiments. What I ſaid of them in the year 1753, may ſuffice, as they have not been varied ſince.

" The plants which I have been ſpeaking of, grew amazingly in thickneſs, height, and largeneſs of ears. They were reaped on the twenty-fifth of July, and yielded five hundred and forty ounces; which is forty-nine times the ſeed, and an ounce over. The birds did no damage at all. This is after the rate of 2041 pounds, or 34 buſhels to an acre, which is a good crop.

" This experiment amounts to a complete demonſtration of the ſuperiority of the new huſbandry. It ſhews, beyond all doubt, how much the earth is more perfectly tilled by it, and that this tilth is laſting, if care be taken to preſerve it by good culture, performed at proper times, and with judgment.

" Can it be thought that a field cultivated in the old way, will, with only pulling up the ſtubble, and without plowing it ſeveral times, even though it be harrowed, ever produce a crop of any corn whatever? Part of the ſeed might indeed ſhoot, and the plants might grow ſome inches high: but they would certainly periſh for want of nouriſhment, which they would not be able to draw from ſuch a ſoil, by reaſon of it's extreme hardneſs: and conſequently they never would be able to produce any grain.

" It was of great importance to ſhew, by an unexceptionable experiment, that lands are brought to much better tilth by the new huſbandry than by the old. This is now completely proved; and no doubt can any longer be made, that the conſequence we drew from it is equally certain; *viz. that land ſo prepared, will produce more than lands which are cultivated ie the common way.* This fact, which is founded on the principles of ſound philoſophy, is likewiſe confirmed by repeated experience.

"The partiſans of both kinds of huſbandry will do well to conſider, that the great principle which we are endeavouring to inculcate, and on which almoſt the whole ſucceſs of the new huſbandry depends, is admitted in the old husbandry: *viz. thoroughly to divide and looſen the earth.* This principle is ſo generally received, that there is not a huſbandman who does not know that one plowing more than ordinary does his land as much good as dunging it would do. His experience has certainly taught him, that this extraordinary plowing produces him better crops: but he is not ſufficiently ſenſible, that, of all the ways of improving his land, no one is more effectual, or leſs expenſive than this. Were the full value of it known, it would be practiſed more: and every farmer would give all his lands at leaſt one plowing extraordinary.

"What we propoſe, is therefore not a novelty capable of giving any huſbandman the leaſt diſlike to the new huſbandry. We all proceed upon the ſame principle, and agree as to it's effect. All of us ſay, *the earth muſt be well divided and thoroughly looſened:* but we differ in the manner of doing it. We propoſe a method by which the ground is much better prepared than in the old way. In this conſiſts all the *novelty.* Whoever rightly conſiders it, and compares it with the principles and experiments, will readily receive it; but he that is determined before-hand, not to enter into this examination, will never enjoy the benefits of it, but will continue plodding on in the old beaten track; not from reaſon, but becauſe others did ſo before him.

" The advantages of the new huſbandry are however ſo great, that it would be doing the public an injury, not to endeavour to make them more and more known. The fitteſt way to anſwer this end, ſeems to be, to exhort all huſbandmen to convince themſelves, by ſtudying the theory of the new huſbandry, weighing the ſolidity of it's principles, and conſulting the experiments which have been already made.

" Every man of common underſtanding, cannot but ſucceed in the practical part; and his example being imitated by others, the new husbandry would ſoon become the general method."

EXPERIMENT, No. II.

N. B. *This field is marked with the ſame number in the Journals of* 1752 *and* 1753.

For the crop of 1752, (p. 137,) *it was ſowed with* 11 *pounds* 4 *ounces of wheat, which yielded* 1041 *pounds* 12 *ounces.*

For the crop of 1753, (p. 156,) *it was ſowed with* 34 *pounds* 14 *ounces, which produced* 1575 *pounds.*

For the crop of 1754, *it was ſowed with* 61 *pounds* 14 *ounces, which yielded* 1820 *pounds.*

" THIS field, which was to be ſowed for the third time, having been brought to a good tilth by former plowings, I prepared it immediately after harveſt, by giving it a plowing like that of the laſt year. I found that I had done right in increaſing the quantity of the ſeed the ſecond year; and, upon examining the plants which the earth had nouriſhed, it ſeemed to me that it could yet bear a greater number, and that I might expect a ſtill greater crop, by adding to the ſeed.

" Accordingly, I ſowed it on the ſixteenth of Auguſt, with 61 pounds 14 ounces of very large and perfectly clean wheat, of my own growth. It was the ſame as I uſed for ſowing all my fields.

" The plants made a very conſiderable progreſs after winter, and ſhot up greatly, notwithſtanding the extraordinary drought. They began to ſpindle on the eighteenth of May; they bloſſomed on the firſt of June; and, being ripe, I cut them down on the tenth of July. They were threſhed a month after harveſt, and yielded 1820 pounds of perfectly clean wheat. Thus we ſee that this field produced in 1754, 245 pounds more than in 1753, and 778 pounds 4 ounces more than in 1752.

EXPERIMENT, No. III.

N. B. *This field is marked with the ſame number in the Journal of* 1753, (p. 162.)

" THIS field, being now in much finer tilth than it was the laſt year, would certainly have produced a greater quantity of wheat. However, I reſolved to ſow it with a foreign wheat, by way of trial. I did ſo, and it yielded me ſcarce any crop at all.

" I thought it might be of great ſervice to try whether wheat of a different quality from that which we uſually cultivate, would not yield more than even wheat of the growth of our own country. At all events it was right to make this trial, though the wheat which I uſed for it was by no means proper for ſowing in our lands. It was Sicilian wheat, the grain of which is very large and extremely hard. I ſowed it on the twenty-firſt of Auguſt. It roſe well; the plants grew very fine before winter, and were extremely thick. But this wheat, being doubtleſs of a much tenderer nature than our common wheat, could not reſiſt the winter's froſt, which almoſt entirely deſtroyed it. Only a few ſtrong plants eſcaped. Theſe grew exceeding fine, branched greatly, and produced very large ears, which contained more grains than thoſe of the wheat of our country. As the plants which ſurvived the froſt were very few, I reaped only about three times the ſeed."

REMARKS on theſe EXPERIMENTS.

"IT is by experience that we can beſt judge how far the advantages aſcribed to the new husbandry are real. The foregoing experiments give riſe to two important obſervations.

"The firſt experiment ſhews us, that lands are brought to much better tilth by the new husbandry, and that they will conſequently produce much greater crops, than in the old way. Experience proves that they have done ſo.

"The ſecond experiment offers us the ſame proofs, but upon a much larger extent of ground. We have the products of three ſucceeding years, and the gradation of their crops. What ought to be particularly attended to here, is, that as the internal pores of the earth became more open, the crops became more plentiful; which juſtifies what we ſaid before, that the crops of the ſecond, third, and following years, would be greater than that of the firſt.

"It was of great conſequence to eſtabliſh this fact, in order to found our calculations of the products upon certain and approved experiments. The following article will afford ſtill farther proofs of this truth.

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ARTICLE II.

Experiments made on lands laid out in beds, and which had borne a ſecond crop. Reflections on theſe experiments.

EXPERIMENT, No. IV.

N. B. *This field is marked with the ſame number in the Journal of* 1753. (p. 165.)

For the crop of 1753, *it was ſowed with* 181 *pounds of wheat, which produced* 3370 *pounds:*

For the crop of 1754, *it was ſowed with* 268 *pounds* 14 *ounces, which produced* 4972 *pounds* 8 *ounces.*

"I MUST remind the reader, that this field was ſowed in 1753, half in beds, and half in equally diſtant rows with the drill-plough. I will ſpeak firſt of the part that was laid out in beds, which continued to be cultivated in the ſame manner for the crop of 1754.

"The plowings made during the year 1753, had the ſame effect upon this land, that is to ſay, they looſened and divided it. It was plowed with eaſe after harveſt; and the new beds having been formed and well prepared, I ſowed them on the ſeventeenth and eighteenth of Auguſt, increaſing the quantity of the ſeed to 268 pounds 14 ounces of wheat. The plants roſe well, and throve greatly before winter; and in the ſpring they made ſtrong ſhoots.

"The winter froſts, and perhaps ſome inſects too, had deſtroyed ſome plants in the rows. I ſaw plainly by this, that I had done right in increaſing

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the quantity of the ſeed. Though the year was dry and hot, the wheat grew to a great height, and ripened well. I reaped it between the tenth and fifteenth of July, and threſhed it out in the winter. This crop yielded me 4972 pounds 8 ounces: ſo that I had this ſecond year 1602 pounds 8 ounces more than the firſt.

" I ſhall ſhorten what I have to ſay of the other half of this field, which was ſowed in equally diſtant rows for the crop of 1753. After harveſt, I made it into beds. But how ſurpriſing was the difference between the mould of theſe two parts of the ſame field, even in this ſecond year! That which had been formed into beds, was fine and light; but this was ſcarcely divided at all; it was full of great hard clods, many of which it was neceſſary to break by hand. Though I had not much hope of it's yielding any great crop, conſidering the condition it was in, I ſowed it on the twenty-ninth and thirty-firſt of Auguſt.

" Theſe beds were but poorly ſtocked with plants, which gathered little ſtrength before winter, and indeed always remained very weak and ſtinted, and, when reaped, yielded ſtill leſs than the other half of the field had done in 1753. But if I have not gained any thing by the crop, I have at leaſt brought my beds into ſuch tilth as aſſures me of a more plentiful harveſt in 1755."

EXPERIMENT, No. V.

N.B. *This field is marked with the ſame number in the Journal of* 1753, (p. 168.)

For the crop of 1753, *it was ſowed with* 139 *pounds, which produced* 2205 *pounds.*

For the crop of 1754, *it was ſowed with* 224 *pounds of wheat, which produced* 2283 *pounds.*

" THE ſoil of this field was of ſuch a nature as rendered the looſening of it more difficult than that of the experiments No. 2, and No. 3, notwithſtanding the culture beſtowed upon it in the ſummer of 1753, which mended it greatly. Still it was not yet in the condition I could have wiſhed, when I ſowed it on the eighteenth and twentieth of *Auguſt*. I ſowed it thicker than it had ever been planted before, merely on account of the badneſs of it's tilth. I beſtowed upon it 224 pounds of wheat, which roſe pretty well, but afforded fewer plants than that of the ſecond experiment. They branched tolerably, and their ears were very fine. I reaped this crop on the nineteenth and twentieth of July, and it yielded 2283 pounds of wheat, which is 78 pounds more than the firſt crop in 1753."

EXPERIMENT, No. VI.

N-B. *This field is marked with the ſame number in the Journal of* 1753, (p. 169.(

For the crop of 1753, *it was ſowed with* 45 *pounds of wheat, which produced* 724 *pounds.*

For the crop of 1754, *it was ſowed with* 82 *pounds of wheat, which produced* 798 *pounds.*

“WHAT I ſaid of the foregoing experiment may likewiſe ſerve for this. All the circumſtances were alike, except that this field was ſowed a few days later, *viz.* on the 27th of Auguſt. It was reaped on the 19th of July, and yielded 798 pounds, which is 74 pounds more than in 1753.”

EXPERIMENT, No. VII.

N. B. *This field is marked with the ſame number in the Journal of* 1753, (p. 169.)

For the crop of 1753, *it was ſowed, as well in that part of it which was made into beds, as in that which was ſowed in equally diſtant rows, with* 412 *pounds of wheat, which produced* 2646 *pounds.*

For the crop of 1754, *the whole field was made into beds, and ſowed with* 360 *pounds, which produced* 2467 *pounds.*

“IT muſt be remembered that one half of this field had borne a firſt crop, and the other a ſecond. From what I have already ſaid, it will be preſumed that the mould of the new beds was not in ſo good condition as that of the others: conſequently the former could not be expected to yield ſo good a crop.

"This field was ſowed on the twenty-firſt and twenty-eighth of Auguſt. It's whole extent took up 360 pounds of wheat, which yielded a crop of 2467 pounds. At firſt ſight, it ſeems to have yielded leſs now, than in 1753: but it muſt be obſerved, that the beds of this field were of two different ages: thoſe which now bore their ſecond crop yielded more than in 1753; but as the ſheaves were not collected ſeparately, I cannot tell exactly the difference of their produce."

Reflections on the experiments contained in this article.

"I HAVE now given an account of four fields which produced their ſecond crops in 1754, all of which were greater than thoſe of 1753, and eſpecially that of the fourth experiment. I am fully ſatisfied, that their produce was proportioned to the preparation of the ſoil. This obſervation ſhews of what conſequence it is to divide and looſen the earth as much as poſſible, by deep plowing and thorough hoeing, in order to bring it to a perfect tilth; which may certainly be done, and that in a ſhort time, by the means which I ſhall point out in the following article.

"Neither our intereſt, nor the knowledge we would acquire of the products which the new huſbandry is capable of yielding, ſuffer us to reſt ſatiſfied with knowing, for example, what the crop of theſe four fields was the ſecond year, and looking upon that as the moſt they will ever produce. We ought likewiſe to examine whether their crop was not diminiſhed by cauſes which we can account for, and which we may reaſonably hope will not take place in other years.

“ By this examination we ſhall find, that the year was not a good one for great crops of wheat. There was not rain enough: the corn grew thin, and yielded but few ſheaves. The ears were indeed full of grain, but the quantity was not ſufficient to make amends for the thinneſs of the crop.

“ The wheat was *ruſted* in autumn; and though this diſtemper ſhewed itſelf in that ſeaſon, in which I think it does the plants leaſt hurt, yet it prevented their branching, ſo much as they would otherwiſe have done, the next ſpring. I obſerved exactly, that the thinneſt places were thoſe where the *ruſt* had prevailed moſt. Laſtly, the froſts which happened in March, did great damage to the wheat. It is therefore not to be wondered at that the crop was not greater. I hope, and I flatter myſelf, not without foundation, that the ſame fields will produce better crops in years exempted from ſuch accidents.

“ I do not pretend that the new huſbandry can ſecure corn from the effects of all theſe accidents: but I have experienced that the crops cultivated in this manner have ſuffered leſs from the intemperature of the ſeaſons, than thoſe which have been raiſed in the common way: for inſtance, they will ſuffer leſs by a great drought, or even not be at all affected by it, if dews fall, which penetrate the well-looſened earth; as I have conſtantly obſerved: and beſides this, the roots of the corn in the new way, being much longer, will extend to a conſiderably greater depth in ground that has been plowed deeper, and will find a moiſture there, which corn in the common way is deprived of.”

ARTICLE III.

Experiments made on lands laid out in beds which had borne a firſt crop: with an account of the manner in which they were tilled, to prepare them for ſowing. Remarks on theſe experiments.

"THE firſt crops of all my fields laid out in beds have hitherto been but ſmall. I eaſily diſcovered that this was owing to two principal cauſes, independent of the intemperature of the ſeaſons. The firſt was, that I ſowed too little ſeed at firſt, and that the quantity was not ſufficient to ſuſtain the accidents which befel my wheat, without being conſiderably diminiſhed thereby. This I remedied afterwards, by increaſing the quantity of the ſeed; which I have continued to do by little and little, from year to year, in proportion to the condition and quality of my land.

"The ſecond cauſe was the bad condition of my lands, which could not be ſufficiently looſened and divided in ſo ſhort a time, and therefore did not afford the plants the quantity of nouriſhment neceſſary to enable them to produce plenty of grain.

"I was in hopes that, by continuing my plowings, I ſhould have better ſucceſs the following years: that is to ſay, that I ſhould bring my land to a looſer ſtate, and that if I gained that point, the crops would certainly be greater afterwards.

"Encouraged by this expectation, and provided with my plough and cultivators, I made no doubt of ſucceeding. To this end, I reſolved to multiply the plowings: and certainly no one ought ever to heſitate ſo to do, even in the common huſbandry; ſo great have been the effects produced thereby.

" I have often reflected on this paſſage in Mr. Duhamel's treatiſe of the culture of land: *One of the Preſident Monteſquieu's farmers reaped a great crop of Spaniſh wheat, from his farm near Clairac, at a time when all his neighbours had very bad crops. The preſident aſked him, what he had done to have ſuch extraordinary ſucceſs. The farmer anſwered, that he had given his ground eleven plowings between ſeed-time and harveſt; and that, by this means, it had reaped the benefit of all the rains, dews, fogs, &c. whilſt the lands of his neighbours were not at all bettered by them, on account of a dry hard cruſt which grew over their grounds, for want of plowing. This obſervation agrees perfectly with the principles on which the new huſbandry is founded.*

" This ſhews us that an active, intelligent, and induſtrious farmer, will always reap the fruit of his labour and expence. But without pretending to ſay that land ought to be plowed quite ſo many times, we learn from this example, that it would be greatly for the public good, to plow it oftener than is generally practiſed.

" I multiplied my plowings, in the ſpring, and till ſeed time. I gave my land ſix plowings in all: but I aſcribe the great benefit which I received, chiefly to the manner in which thoſe plowings were performed, and to which I beg the reader ſeriouſly to attend.

" After the beds were formed, my method was this. I changed their poſition, by removing the middle of the beds to the place where the great furrow in the middle of the alley was before; or, to explain myſelf ſtill better, I then performed the ſame plowing as we do after the firſt crop is reaped.

" This operation is of ſuch importance, that it requires my being ſtill more explicit. I ſhall therefore relate the whole proceſs of the preparation of my land. In the firſt place, I plowed it twice, as deep as I poſſibly could, in broad lands. The beds were formed at the third plowing. I afterwards gave a fourth plowing, to raiſe them ſtill higher, by opening the firſt furrow in the middle or higheſt part of the beds, and turning the earth on both ſides up againſt that middle, by which means the beds were arched very high, and a great furrow was left in the middle of the alleys. I went farther yet; and this I ought to reckon as a ſeventh operation: I cut the great furrow in the middle of the alley ſtill deeper, with one turn of my cultivator with two mould-boards.

"The beds thus prepared were certainly in excellent order for ſowing: I never had them in ſo good condition before: but I was willing to go ſtill farther, and that for the following reaſon.

"I had obſerved, that there is always a greater depth of fine mould in the middle of the bed, when it is placed in the ſpace before occupied by the main furrow in the middle of the alley. My beds were not diſpoſed in this manner till the ſecond year.

"I therefore thought it adviſeable to change the place of the beds. I did ſo, at the fifth plowing, by filling up the great furrow, which now became the middle of the new bed. As the earth was in a very looſe ſtate, a great deal of it was heaped up by each turn of the plough, with eaſe to the horſes, and with ſpeed. The middle of the beds was raiſed as much as might have been thought neceſſary: but I raiſed it ſtill higher, at the ſixth and laſt plowing, by cutting the firſt furrow in the middle of the bed, and turning the earth up from right and left towards it.

"By theſe plowings, the mould of the beds will be admirably well prepared even the firſt year, and the ſeed ſowed therein will not fail to vegetate very abundantly. It is by this means that I have brought the middle of my beds to the depth of 15 or 18 inches of fine looſe mould, in which the perpendicular roots of the plants extend themſelves and multiply eaſily, and find plenty of nouriſhment, which they afterwards tranſmit to the plants themſelves.

" I ſhall mention farther, as a proof of the fineneſs to which theſe plowings brought the earth, that I was not obliged to harrow my beds before I ſowed them.

" Some may perhaps object, that all this requires much labour, great trouble, and conſiderable expence: and how, will it be added, can one find time for ſo many plowings?

" To this I anſwer: firſt, that allowing all this to be true, the crop will make ample amends for it. What follows will eſtabliſh this truth beyond all doubt.

" Secondly, that this labour ought not to diſcourage any one. The four firſt plowings are abſolutely neceſſary, as all will agree; and the fifth and ſixth are performed with ſuch eaſe, and in ſo much leſs time than the common plowings, and eſpecially the laſt, for which one horſe will generally be ſufficient, that it will eaſily be perceived I do not propoſe a thing either too difficult or too expenſive to execute.

" The fields of the three experiments of this article, were prepared in the manner I have now related."

EXPERIMENT, No. VIII.

" THE ſoil of this field is very good and ſtrong. It's extent is one acre and twelve poles. I made the beds about ſix feet wide; and each bed was ſowed with two turns of the drill-plough, which were to make ſix rows: but the difficulty of guiding the plough ſo as to keep the three laſt rows exactly parallel to the three firſt, was ſo great, that the two middle rows were frequently jumbled together, ſo that there were in fact but five rows in ſome places. The ſpace which remained between the outer row of one bed and the outer row of the next bed, left an alley wide enough to be plowed. I muſt obſerve that our farmers hereabouts liked this way of ſowing much better than the firſt, in which I likewiſe made the beds ſix feet wide, and ſowed them with only three rows.

" I ſowed each row a little thinner than in the former experiments: but as there were more of them in each bed, they would of courſe require a greater quantity of ſeed. This field was ſowed on the 27th of Auguſt, with 76 pounds 8 ounces of wheat.

" All my plants were equally fine till winter, and ſhot up with great vigour in the ſpring. They grew exceeding high, branched abundantly, and produced very large ears, among which there was but little difference. This crop was reaped on the ſeventh of July, and yielded 1462 pounds of wheat.

" This produce made me good amends for the labour I had beſtowed upon the ground. It is after the rate of about 1500 pounds, or 25 buſhels to an acre."

EXPERIMENT, No. IX.

" THIS field is of a very indifferent quality, and had hitherto yielded but ſmall crops. It's extent is 4 acres, 3 roods, 8 poles, and 9 feet: It was ſowed on the ſeventh and eighth of Auguſt, in the ſame manner as the former, with 249 pounds 12 ounces of wheat.

"The young plants ſhot up as thick, and looked as ſtrong and of as good a colour, as thoſe of the foregoing experiment: but the ruſt took them all in October and November; and their blades, which were of the fineſt green before, turned yellow, and perfectly covered the ground with the powder of this ruſt. My plants ſuffered greatly by this accident. They branched imperfectly, and conſequently grew very thin. Their ſtalks were, however, long, and bore fine ears. They were reaped on the 8th of July, and yielded 2925 pounds of wheat.

EXPERIMENT, No. X.

"THE ſoil of this field is rather inferior, than equal, to that of the field we ſpoke of laſt, whoſe fate it likewiſe ſuffered in every reſpect. The young plants were extremely fine, and, in October and November, they were ruſted almoſt as much as the others: This field contains 3 acres, 3 roods, and 9 poles. As I thought this land inferior to the other, I ſowed it thicker; uſing to this end 294 pounds of wheat. It was ſowed on the 8th, 17th, and 28th of Auguſt; not being able to do it in any three days running. The crop yielded 3055 pounds.

Remarks on theſe experiments.

"I HAVE now been able to obtain better crops, even the firſt year, by the new huſbandry, than any I ever had before. I think there can be no doubt but that this ſucceſs is owing firſt, and chiefly, to the better preparation of the ground;

and ſecondly, to a proper increaſe of the ſeed. Upon the whole, I am inclined to think, that the ſowing each bed with two turns of the drill-plough increaſed the crop. But of that I ſay no more at preſent, as I intend to treat expreſly of it in the eighth article.

" All my obſervations ſhew, how much I am convinced of the importance of bringing the earth to a fine looſe ſtate: nor can I recommend it too ſtrongly. I have ſenſibly experienced the good effects of it in all my lands, and particularly in thoſe of the ninth and tenth experiments; for, though theſe fields are but of an indifferent quality, they have produced plants equal to thoſe of my very beſt lands.

" After what I have now ſaid, no one will be ſurpriſed that almoſt all my firſt crops were but ſmall, ſince moſt of the lands were ſown after a ſingle plowing, which was not ſufficient to prepare them properly. I was indeed well appriſed of this defect at my firſt ſetting out: but all I then aimed at was, to lay all my fields into beds as ſoon as poſſible; being thoroughly ſatisfied that it would not be long after, before I ſhould be able to bring them to a proper tilth, with great eaſe and little coſt.

" Theſe three experiments not only ſhew us how to conduct our works more profitably hereafter; but they likewiſe diſcover a new advantage in this huſbandry, which indeed I ſuſpected from my very firſt experiments. It is of importance to take notice of it here.

" All the experiments made by different perſons, and in different places, have ſhewn us, that wheat cultivated according to the new huſbandry is very little apt to lodge; that the great ſtrength of it's ſtalk ſupports it, and that it reſiſts the force of the wind much better than that which is raiſed after the common method, the ſtalks of which almoſt always give way in ſtormy weather.

" It muſt however be acknowledged, that the wheat of the new culture is not abſolutely able to reſiſt extremely violent winds accompanied with great rain. But would any one expect that the accident I am now going to ſpeak of, far from hurting the wheat, ſeemed to me to be of great ſervice to it, particularly in very rainy years, or when cold dews fall about the time of it's ripening?

" I obſerved, in the account of my experiments in 1752, that my wheat was not lodged; but that ſome of it was bent, without ſuffering any damage thereby. I added, *that I imagined it might be of ſervice to the wheat not to remain always in an exactly perpendicular ſituation.* I purpoſed watching cloſely what effect the ſituation of this would have. I could not be ſatisfied in this in 1753; but the year 1754 furniſhed me with obſervations, and afforded me advantages with reſpect to the quality of wheat, which it is always of very great ſervice to know.

" Wheat grows and ſhoots up pretty perpendicularly; without altering this direction, unleſs it meets with ſome obſtacle. The moſt formidable is a violent wind, accompanied with great and heavy rains, which lodge it. Every one knows, that when wheat is lodged ſoon after it has done bloſſoming, it yields ſcarce any grain; and that what it does yield, is very ſmall and ſhrivelled, and contains very little flour: a manifeſt, and oftentimes very conſiderable loſs.

" The wheat which is only bent, continues to grow in that ſituation: it's ears ſwell and fill equally with grain to the very point, abounding plentifully with good and very nouriſhing flour. Thus no loſs is ſuſtained in this caſe; and this inclined ſituation of the ſtalk does not at all interrupt the functions of the nutritive juices, as in wheat which is lodged. The growth of the plants in this ſituation proves plainly that their vegetation is not ſtopt.

" This bending of the ſtalks no way hinders a ſkilful and careful huſbandman from giving another plowing, if it be neceſſary. I had it done in the field of the eighth experiment, without deſtroying or hurting a ſingle ear.

" All the beds of the three fields on which the experiments mentioned in this article were made, are in the ſame direction, *viz.* from eaſt to weſt, and lie ſomewhat ſloping towards the weſt. Soon after the wheat had done bloſſoming, a ſtrong ſouth wind blew for ſome hours, accompanied with a heavy rain, which made all the wheat of theſe three fields incline towards the north. It remained in this ſituation till harveſt, and the ſtalks grew ſo crooked that the points of the ears turned down towards the ground: they remained thus ſuſpended, by the ſtrength of the ſtalks, which ſeemed even to increaſe; for I did not find that they bent any more, though the weight of the ear increaſed as the grain grew riper.

" In this ſituation, this wheat continued to proſper: the ears filled with grain to the very point: they grew as large and heavy as thoſe of the other fields; and had beſides, the advantage of being of a finer colour. This quality helps corn to ſell ſooner and more eaſily, becauſe the buyer judges by his ſight more than by his other ſenſes. It is of conſequence in all ſorts of goods, to catch the eye; but there is no fear of it's deceiving one in the choice of wheat: the good colour of the grain is always a ſure ſign of it's ſoundneſs, and invites the purchaſer to buy it with confidence.

" Since then there is no fear that any damage will ariſe from wheat's being bent, there is no cauſe to repine or be uneaſy at ſeeing it in that ſituation. But, beſides what I have been ſaying, I muſt now offer ſome reaſons why I think it may perhaps be better for wheat to be bent and curved in that manner, than for it to grow almoſt quite upright.

" Let us conſider what effect rain, the moiſture of the air, and dews have upon the ears of corn in both theſe ſituations. When the ears ſtand upright, and almoſt perpendicular, they retain a great deal of wet in rainy and dewy weather. This wet inſinuates itſelf very eaſily between the huſks which cover the grain, and gets even into the inſide of them. This water, thus got within them, remains there, and does not evaporate ſo eaſily as that which is only upon the outer ſurface of the huſks, which the motion of the air or the ſun, diſſipates in a ſhort time.

" It may happen too, but I ſhall not give it as a fact which I have yet ſufficiently obſerved, *that the water which has penetrated between the huſks, touches immediately the grain itſelf*. Now this moiſture all around it, in whatever manner it gets there, muſt certainly be very prejudicial to the grain; and the longer it ſtays there, the more hurt it muſt do. We have ſeen ſuch continual rains in ſome years, that, for ſeveral days together, even the outſide of the ears could not be wiped dry, but they have remained wet ſo long, that the corn has ſprouted while it ſtood upon the ground. But, without ſuppoſing the miſchief to be always ſo great, wet, by remaining too long upon the grain, may, in ſome meaſure, ruſt it a little, as it ruſts ſtraw while ſtanding. I have ſeen this happen, though indeed but ſeldom.

" The imperfection which is often found in the quality of the grains, and their ſometimes leſs pleaſing taſte, may, with great probability, be imputed to this caſe: and perhaps it may be found upon ſtricter inquiries than thoſe I have hitherto been able to make, that the moiſture too long retained around the grain, towards the latter end of it's growth, and particularly that of cold dews, is the real cauſe of the fatal and ſudden changes which often befall wheat in grain, a little before harveſt, and rob us of the beſt part of a crop which was juſt before thought to be quite out of danger.

"When the wheat is inclined, it's ſtalks bent downwards arch-wiſe, and the point of the ears turned down towards the ground, it is plain that no wet, either of rain or dews, can ſo eaſily get at the grain, and that only the outer ſurface of the huſks will be immediately touched by it: the water, not being able in this ſituation to glide in between the interſtices of the huſks, will drip down from one huſk to another till it comes to the point, and then will fall to the ground. Theſe huſks are ſoon dried again; and the ears which grow in this manner are much leſs expoſed to the conſequences of the wet, than thoſe which remain in a perpendicular ſituation; and conſequently their grain ought to be better conditioned.

"This advantage can be enjoyed only in the new huſbandry; for in the old way, the wheat is either lodged quite flat, or ſtands quite upright; ſcarce any of it's ſtalks are ſtrong enough to ſupport the ſmall weight of the ear, when bent and inclined towards the earth.

ARTICLE IV.

Experiments made on lands laid out in beds, which have borne a firſt and ſecond crop; together with ſome intereſting obſervations.

EXPERIMENT, No. XI.

“IN the journal of 1753, (p. 170.) I gave an account of the experiments which a perſon had made upon about twenty-eight acres laid out in beds about ſix feet wide, and which did not meet with the deſired ſucceſs. I added, that the ſame perſon, perſuaded nevertheleſs of the advantages of this culture, had prepared twenty-five acres more in the ſame manner, and that all of them were ſown for the crop of 1754.

“All this ground was plowed with care, and part of it was ſown earlier than the year before. Some little addition was likewiſe made to the quantity of the ſeed. The plants in general roſe extremely well, and were ſtrong and healthy before winter, in proportion to the time of their being ſown, and to the quality and condition of the land.

“Such a beginning gave room to hope that theſe fields would yield a pretty good crop: but the winter ruined all; and ſcarce any thing was reaped from ſo large an extent of ground.

Obſervations on this Experiment.

“IT would have been unfair in me not to mention this experiment, though it anſwered ſo badly. The reader may be ſurpriſed at firſt, to ſee ſo great a contraſt between this and my own experiments,

ments, in which, notwithſtanding the intemperature of the ſeaſons, and other accidents, he finds the crops increaſe, as the land becomes better tilled according to the principles of the new huſbandry. This increaſe was what we foretold would happen: but the field we are now ſpeaking of, produced leſs the ſecond year than it did the firſt, though even that was very little.

" There muſt then neceſſarily have been ſome differences between theſe fields, to which this great diſparity of their crops was owing. Theſe differences doubtleſs were, either in the quality of the ſoils, the preparation of them, their expoſition, the quantity of the ſeed, the accidents that befel them, which might be greater or leſs, in ſome than in others; or, in ſhort, many other cauſes capable of helping or hurting the crop: for otherwiſe, ſuppoſing all theſe things to be equal, or nearly ſo, the diſparity in their crops could not have been great.

" Not to impute the bad ſucceſs of this laſt experiment too lightly to the new huſbandry, we ought, in juſtice, to examine whether it might not be owing to ſome other cauſe, and whether there may not be room to hope for better ſucceſs another time.

" Theſe fields, without being all exactly of the ſame quality, are generally reputed in the country *cold and ſtiff lands, and very apt to grow hard.* Such lands will certainly require more time, more patience, and more perſeverance, to bring them to any degree of tilth: more plowings will be neceſſary, and thoſe plowings muſt be given in the moſt proper ſeaſons. By continuing to ſtir them well, their hardneſs and reſiſtance will be overcome, their pores will be opened and multiplied, and plants will then thrive in them as well as in the beſt of ſoils.

" All lands ought to be treated according to their reſpective qualities. There is great reaſon to believe that this field, when prepared as thoſe of the experiments No. VIII, IX, and X, were, will hereafter produce great plenty of corn. What I now ſay, is not mere conjecture. Repeated experiments, the effects of which have been conſtantly the ſame, have taught me, and I can ſafely affirm, that extremely bad lands, which could not ſo much as yield a crop that would pay the expence of tilling them, have been rendered good and fertile merely by plowing, and without the aſſiſtance of any manure.

" This is a ſtriking truth. It was what firſt determined me to practiſe the new huſbandry; and therefore it was of conſequence to me to be certain of it. To this end, I reſolved to make a trial upon a ſmall ſpot of ground, which I knew to be incapable of producing any thing in it's then ſtate.

" Some years before, I had dug away the earth three feet deep, from a ſpace of 360 feet ſquare. Nothing remained in it but a cloſe white clay, fit for potters uſe. This ſpot, thus circumſtanced, ſeemed to me a proper one for my experiment. As the ſpace was too ſmall for the plough to work in, I made uſe of the ſpade and hoe. It was made into beds, which were afterwards ſown with wheat, and the ſpaces between them were frequently ſtirred. The firſt year, my plants were very poor, and branched into only two, three, or four ſtalks a-piece. The ſecond year, they did much better; and the third year, they were as large and fine as any my garden could have produced. This ſpot ſtill continues to produce equally well.

" We have here a remarkable inſtance of what may be done by ſufficiently pulveriſing the earth: that which I am ſpeaking of, is now like mould;

and, which is very remarkable, it has loſt it's former white colour, and now is black. Let us but do the ſame with any of our bad lands, and perſevere in plowing and ſtirring them a ſufficient time: the ſucceſs will not be doubtful.

" But to return to the ſubject of this article. Some of the fields we were ſpeaking of are ſurrounded by, or border upon woods. This ſituation is far from being good, and it ſeldom happens but that ſuch a neighbourhood does great injury to the crops.

" I could likewiſe have wiſhed, that a larger quantity of ſeed had been employed to ſow theſe fields. The loſs occaſioned by the froſt might have beeh leſſened thereby, as it may be preſumed that a greater number of plants would have eſcaped, if they had been thicker in the places where all of them were not intirely deſtroyed.

" We obſerved before, that the young plants were in a fine condition before winter, and that they promiſed well: but the ſeverity of the froſts, doubtleſs too great for the condition and ſituation of theſe lands, did an irreparable injury to almoſt all theſe fields.

" I examined the greateſt part of them in the beginning of the ſpring. Of all thoſe which I ſaw, I found but one ſpot, of three or four acres, where the earth was in the condition it ought to be, that is, well ſtirred and broken, looſe, light, and penetrable. Too few plants were left in this good ſpot; large ſpaces were quite empty in moſt of the rows: but thoſe which reſiſted grew very fine in the ſummer, branched extremely well, and bore fine ears.

" By this one might gueſs what theſe lands were capable of. My opinion is, that, in other years, free from ſuch accidents, the rows will remain well ſtocked with plants, which, finding an equal plenty of nouriſhment, will be nearly of equal ſtrength and beauty in every part, and, all together, will produce a conſiderable quantity of corn.

" The other fields were infinitely worſe treated*. Every thing was deſtroyed for ſeveral acres together. The plants were rooted up by the ſtrength of the froſt, and lay ſcattered upon the ground all along the rows, withered and unable to recover the leaſt vigour. Theſe are the only fields laid out in beds, in which I have ſeen this extraordinary accident: not a plant was rooted up any where elſe. It is very difficult not to ſuſpect that there muſt have been ſome fault in the ſowing, and that the ſeed, perhaps, was not buried deep enough. The roots which were too near the ſurface of the earth, were nipped by the froſt. They muſt have been ſo, ſuppoſing them to be but about two inches deep. We likewiſe know, with certainty, that if the ſeed had been ſown in good time, the plants would have had roots above ſix inches long; and that ſuch roots would have ſecured them from being killed by the froſt. There is room therefore to believe that the ſeed was not buried deep enough.

" But even ſuppoſing the plants not to have been deſtroyed, I doubt whether they would have yielded a good crop; becauſe the ground, eſpecially that of the partitions between the rows, was extremely hard and cloſe, and therefore quite unfit to ſupply the plants with their neceſſary nouriſhment.

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* All theſe obſervations, ſays M. Duhamel, ſhew that this land is of the nature of thoſe which ſwell greatly in hard froſts, and, ſubſiding again upon a thaw, leave the roots of plants quite bare upon their ſurface. In whatever manner ſuch lands are cultivated, they ſeldom produce any thing if the winter is ſevere. The beſt way is to ſow them with ſpring corn.

" This experiment required theſe remarks: many more might be added; but theſe are ſufficient to ſhew, that ſome lands require a double portion of care and labour."

EXPERIMENT, No. XII.

"THE account of the ninth experiment, in 1753, (p. 172,) promiſed better ſucceſs the next year. The whole culture was performed by the ſame perſon, with great care and extraordinary judgment, in two fields, containing about ten acres. One of theſe fields is much better than the other: the beds were about ſix feet wide: one half of the worſt field was dunged; but not above a third part as much as it would have been in the common way. The ſoil of this field is very ſtiff. It had not been plowed for 15 or 20 years, and was not yet ſufficiently looſened and divided.

" It was ſowed early: the plants roſe very well, but were greatly hurt by the froſt, excepting thoſe which the dung preſerved. The ſame thing happened to the beds which were ſown with ſix rows.

" The ſoil of the other field is richer and of a better quality. The winter did it little hurt. The plants throve by the culture which was given them, but leſs than was expected; owing, as is ſuppoſed, to the great drought of the ſeaſon. Theſe two fields produced, however, about 7000 pounds of wheat; which is extremely well, eſpecially for a firſt crop.

" Theſe two fields have given us room to make two reflections. Firſt, that *the earth muſt be well prepared, without which the plants are not able to extend their roots to the plowed part of the alleys.* Secondly, that, *in dry ſprings, the plants of wheat preſerve one another mutually from the drought*; *for which* *reaſon it is proper to ſow ſomewhat more than would otherwiſe be neceſſary.*

"The ſame culture is now practiſed for the year 1755, and is extended to about fifteen acres more."

EXPERIMENT, No. XIII.

"I mention this experiment on account of the faults committed by the huſbandman, in order that others may take care to avoid them. Near three acres of pretty well plowed land, made into beds, produced only about 780 pounds of wheat the ſecond year.

"The reaſons why this crop was ſo ſcanty are evident. In the firſt place, too little ſeed was ſowed; there ought to have been three times the quantity. Secondly, the beds were of an exceſſive breadth, all of them being eight or nine feet wide, and ſown with only three rows. By this means, great part of the ground was loſt; which ought carefully to be avoided.

"The plowings too were made in a very ſlovenly manner; the huſbandman gave them, not when they were neceſſary, but when it ſuited his convenience. The reaſon was, that he was prejudiced againſt the new huſbandry, and did not deſire to ſee it ſucceed."

ARTICLE V.

Experiments made by ſeveral lovers of Agriculture, on lands ſown in equally diſtant rows with the drill-plough.

"SOME of the principles of the new huſbandry have been adopted in this way of ſowing; and even the common plowing is now performed

formed with more care than it was before the great advantage of thoroughly dividing and breaking the earth was ſo well known. This method of ſowing the land all over in equally diſtant rows, being, in appearance, eaſier and more ſimple than forming it into beds, has now a great number of partiſans: and, indeed, the lands which have been ſown in this manner, have yielded much better crops than the fields cultivated in the old way."

EXPERIMENT, No. XIV.

"IT is pretty generally the cuſtom about Geneva, if the land is good, to ſow it in April, over the wheat, with clover ſeed, which yields a crop the next year. Agreeable to this cuſtom, a field of about three acres was ſowed with clover in April, 1752. In 1753 it yielded two crops of clover, after which the owner of the ground gave it three good plowings in the common way. The clods which the plow had left, were broken by hand before the field was ſowed; for he was determined not to ſpare any pains to give it a good preparation.

"About 630 pounds of wheat uſed generally to be employed to ſow this field: but it was now ſown , on the fourteenth of September, with only 315 pounds. The earth was extremely dry, and the weather very hot, which it continued to be for ten days longer; circumſtances which ought to be attended to, and which it will be proper the reader ſhould remember when he comes to the continuation of this experiment in the ſeventh article.

"This field was plentifully ſtocked with plants. They yielded 2926 pounds of wheat. In proportion to the produce of the other fields of the ſame farm, this would have yielded, at moſt, only between 18 and 1900 pounds: conſequently here is a gain a gain of about 1026 pounds, beſides 315 pounds ſaved in the ſeed, which makes in all a profit of 1341 pounds."

EXPERIMENT, No. XV.

"THE ſame perſon who made the experiments No. VII. in 1752, (p. 145,) and No. X. (p. 173,) and XI. in 1753, (p. 175,) continued them in compariſon with the old huſbandry. They anſwered as before, and the ſame advantages were again confirmed. A detail of the particulars would be needleſs. I ſhall only add, that barley, with which the experiment was likewiſe tried, anſwered much beyond any thing that was expected, and yielded a prodigious crop.

"The farmer, convinced by ſuch ſucceſs, of the ſuperiority of the new huſbandry over the old, immediately deſired his landlord not to make any more experiments by way of compariſon, but to let him ſow all his lands with the drill-plough."

EXPERIMENT, No. XVI.

"THIS experiment was made in the ſame farm where the XIIIth and XIVth (p. 176,) were made in 1753. All the lands were very well prepared, and ſowed with the drill-plough.

"One of theſe fields, containing about four acres, which uſed to require 880 pounds of ſeed, was now ſowed with 315 pounds. The plants were extremely fine, both before and after winter, and, when reaped, yielded 4940 pounds of wheat. If it had been ſown in the common way, it could not have been expected to yield above 2900 or 3000 pounds: conſequently, it now produced 1940 pounds more; to which if we add 565 pounds ſaved in the ſeed, we ſhall have 2505 pounds of wheat more by the new, than would have been obtained by the old husbandry.

“ Another field, of an inferior quality, the extent of which is near nine acres, uſed, in the old way, to be ſown with 1764 pounds of wheat, and was now ſowed with only 819 pounds, which produced about 5720 pounds. Though the difference in the goodneſs of the lands is conſiderable, yet the drill-plough ſtill maintains it's ſuperiority : for, if this field had been ſowed in the common way, it would have been thought to have produced an exceeding good crop, if it had yielded between 5200 and 5300 pounds, though that would have been 420 pounds leſs than this, which, added to the 935 pounds ſaved in the ſeed, make this crop 1355 pounds greater than it would have been in the old way.

“ A ſmall ſpot, of about an acre and a quarter, which uſed commonly to be ſowed with 157 pounds of wheat, was ſowed with 63 pounds, and produced about 430 pounds. This is nearly the ſame proportion as the foregoing experiment.

“ Theſe fields, being ſome better than others, may ſerve to ſhew what may be expected from lands of different qualities.

“ A piece of ground of thirty acres was likewiſe plowed with care. This, to have ſowed it in the old way, would have required about 6550 pounds of ſeed, which would have yielded at moſt 20000 pounds. I even think that I over-rate it in this.

“ Theſe thirty acres were ſown with 2772 pounds of wheat. Here is, in the firſt place, a ſaving of 3778 pounds in the ſeed, which is a very conſiderable object. The whole crop yielded about 19000 pounds, which added to the 3778 pounds ſaved in the ſeed, make 22778 pounds. The profit therefore is 2278 pounds more in the new way, than in the old.

"To ſet this experiment in a yet clearer light, I ſhall add, that the ſheaves were ſtrong, the ſtraw fine, the grain very clean and plump, and that half theſe fields had ſuffered conſiderably by the froſts in March.

"The produce of a few detached pieces of land might not have been ſufficient to perſuade the generality of mankind, ſo much as to adopt even this change, which conſiſts ſolely in the manner of ſowing the ground. They might ſtill think it imprudent to give up a certain profit for an uncertain one: It will therefore be proper to let them ſee, by the management of a whole farm, that this huſbandry may be practiſed to very great advantage. This will be ſhewn in the following article.

EXPERIMENT, No. XVII.

"THIS experiment, which is a very conſiderable one, was executed on the ſame perſon's lands, who made the experiment No 12, in 1753 (p. 175,). All the lands were ſown with the drill-plough. They were plowed four times, and a ſmall part of the whole was dunged. I cannot enter into all the details of this operation; but the general reſults, which we ſhall give, will be ſufficient.

"The lands of which we are ſpeaking, compoſe three farms, ſituated in three different villages, about a mile and a half aſunder. Theſe ands are of different qualities; ſome ſtiff, others pretty light, others of a middling quality, and but little ſtony.

"About 100 acres were cultivated in the firſt farm, 40 in the ſecond, and 40 likewiſe in the third. In all 180 acres.

For

		Pounds.	
The quantity of ſeed uſed in the common way, was,	For the firſt farm, ſowed in Auguſt and September . .	21420	of wheat.
	For the ſecond farm, ſowed between the 1ſt and 15th of October	8190	
	For the third farm, ſowed between the 20th and 30th of October	8190	
	In all . . .	37800	

		Pounds.	
The quantity of ſeed ſown with the drill-plough, was	For the firſt farm	8190	of wheat.
	For the ſecond farm	3276	
	For the third farm	3276	
	In all . . .	14742	
	Saved in the ſeed . . .	23058	
	Total . .	37800	

		Pounds.	
Crops in 1754.	Firſt farm . .	70200	of wheat.
	Second farm . .	22750	
	Third farm . .	15210	
	Total crop . .	108160	
	To which muſt be added the ſaving in the ſeed	23058	
	The whole profit is . . lb.	131218	of wheat.

" It will be right to ſee now what the ſame extent of land might poſſibly have produced, if it had been cultivated in the old way. This can indeed only be gueſſed at, and I chuſe therein to favour the old huſbandry. According to the general run of this year's crops, theſe three farms would have produced, at moſt, about 95000 or 100000 pounds of wheat; which would conſequently have been 31218 pounds ſhort of what they yielded in the new huſbandry.

" This way of ſtating the account of the produce of both methods, is a fair one. *The ſaving in the ſeed is always to be reckoned.* But I have perceived, by the queſtions which ſeveral perſons have aſked me with regard to accounts thus ſtated, that they were not clearly underſtood. I ſhall therefore throw them into another form, which has been thought more diſtinct, but of which the reſults will ſtill be the ſame.

" We will reckon only the real and actual produce, and then ſubſtract the ſeed: the remainder will conſequently be the neat produce.

NEW METHOD.

Total produce	108160 lb.
To be deducted for the ſeed	14742 lb.
Neat produce	93418 lb.

OLD METHOD.

Total produce	100000 lb.
To be deducted for the ſeed	37800 lb.
Neat produce	62200 lb.
" Therefore the new method produced more than the old would have done	31218 lb.
Proof	93418 lb.

" Which reſult is the ſame as that of the other compariſon.

" Are not ſuch advantages well worthy the attention of every one concerned in huſbandry ?

EXPERIMENT, No. XVIII.

" WE ſaw by the 15th experiment in 1753, (p. 177,) that the fields which I had ſowed, with the drill-plough, in equally diſtant rows, yielded very little corn. I mentioned the cauſes, which I knew. I have not yet had time to form them into beds, by which means I ſhall certainly remedy the too great coheſion of the ſoil, and without which thoſe lands will never yield any other than poor crops, as they have almoſt always done whilſt cultivated in the old way, which is infinitely leſs fit for lands that require a great deal of ſtirring, than for ſuch as are naturally fruitful.

" I hope I ſhall be able to begin next year to practiſe the new husbandry in this farm. I ſhould have done it before now, if I could have made any ſtay there : but as I could not, I have only continued to ſow it with the drill-plough in equally diſtant rows.

" I ſhall mention another ſmall farm, on which no dung or any other kind of manure was uſed, though it's lands, at leaſt the greateſt part of them, are but very indifferent.

" I ſowed theſe lands towards the end of Auguſt and the beginning of September, in pretty hot and dry weather. The whole extent of this little farm is between twenty-two and twenty-three acres, which uſed to take up 4662 pounds of ſeed: but only 1950 pounds were employed now.

" Some places looked well enough ; but in general the wheat came up thin. I was however very well ſatisfied with my crop, which yielded about

13000 pounds of exceeding fine wheat, ſo clean that it wanted no ſifting. If I had not ſowed with the drill-plough, I ſhould ſcarcely have reaped more than barely the ſeed: for that was the caſe with all my neighbours, who had only about their ſeed and half as much over; and many of their crops yielded ſtill leſs. It is not to be ſuppoſed that I ſhould have fared better than them, if I had followed the old way, as they did."

ARTICLE VI.

Summary accounts of the products of ſeveral pieces of land ſowed in equally diſtant rows with the drill-plough.

EXPERIMENT, No. XIX.

"As nothing but a great number of experiments, repeated under different circumſtances and in different places, can convince many of the advantages of the new huſbandry; I am the more readily induced to mention all that have come to my knowledge; though there are among them ſeveral of which I have not been able to get ſo particular a detail as I could have wiſhed: all that has been told me in relation to many of them being, that thoſe who made them were well ſatisfied with the crops they had obtained by means of the drill-plough, and that they intended to continue uſing it: but the following experiments will merit the reader's attention.

" The lands I am going to ſpeak of are ſituated in a diſtrict of near thirty ſquare miles, and there are great differences in their qualities and ſituations; they were not all plowed with equal care: ſome of them were dunged, and others were not; and laſtly, the drought was greater in ſome places than in others. Notwithſtanding all theſe diverſities, it will appear from what we are going to ſay, that the uſe of the drill-plough was every where attended with uncommon ſucceſs.

" To ſhorten, and at the ſame time give the reader a full view of the purport of this article, I have drawn up a table of the extent of the ſeveral pieces of land, the quantity of ſeed uſed for ſowing them in the old way, the quantity they were ſown with in the new huſbandry, and their produce in this laſt culture. Though theſe experiments are not related ſo exactly as my own, I am ſure there is no miſtake of any conſequence in them.

" I ſhould have been very glad to have known likewiſe the exact products of the crops in the old way. I have done all I could to come at the knowledge of them, but have obtained only very few ſatisfactory accounts. All that I have been able to learn, amounts only to a confirmation of what I found in my accounts of the culture and produce of my own eſtate; of which an exact account has been kept for about forty years paſt. Beyond that time, my papers furniſh me with only the produce of now and then a year, but not of any number of years together. Theſe detached hints have however afforded me ſome curious and uſeful knowledge. For example, I have learnt by them, that the produce of land was the ſame in the laſt age as it is in this. In the year 1668, which is the fartheſt back that any of my papers take notice of, I find that the crops were like thoſe which the ſame lands have yielded for theſe laſt thirty or forty years.

" All my inquiries have ſhewn me that, in this country, in what are reckoned good years, the lands yield but three times the ſeed; ſeldom more, and often leſs. Some few fields indeed muſt be excepted, which, being of a very extraordinary goodneſs, do produce more: and likewiſe, on the other hand, ſome very bad lands which do not yield ſo much: ſo that, upon the whole, this may be reckoned the medium crop during any number of years.

"The neat produce does not by any means amount to the whole of the crop, in the common huſbandry: for the good grain is frequently ſo mixed with bad, and with the ſeeds of weeds, that it ſuffers a conſiderable diminution thereby. The quantity of perfect grain is therefore what ought to be conſidered; and in this many are apt to deceive themſelves. Whenever people become ſenſible of the ſmall advantage of the common huſbandry, they will be more ready to attend to what is ſaid in favour of the new, and will be inclined to verify it by their own experience. When ſo convinced, they will endeavour to overcome the diſlike which moſt farmers have to this new method. They are, in general, a ſet of men, fit only to execute what they are bid to do; and therefore ought to be directed by perſons of better underſtanding. Patience and perſeverance may by degrees induce them to practiſe the new huſbandry, which time will bring to it's greateſt perfection.

"The following table will help to ſtrengthen theſe reflections."

TABLE

TABLE

Of the Extent, Sowing, aud Crops of different Pieces of Land in 1754.

Extent.	Quantity of ſeed in the old way.	Quantity of ſeed in the new way.	Crops.
Acres.	Pounds.	Pounds.	Pounds.
2	336	168	1560
2	356	180	1230
4¼	882	392	2360
1¼	252	130	650
4¼	882	346	2275
3½	672	283	2080
9½	2016	670	6110
5	1008	485	4680
1	190	95	1040
2½	504	230	2520
4¼	819	390	3120
1¾	315	140	975
2¾	694	300	2340
Total 44	8926	3809	30940

ARTICLE VII.

General Reflections and Obſervations on the Experiments contained in the foregoing Articles.

"AFTER all theſe experiments, I aſk myſelf, whether they are ſufficient to give us a ſatisfactory demonſtration that the new huſbandry is more profitable than the old? I anſwer, without heſitation, that it certainly is more profitable, both to the public, and to each individual, whether the lands be cultivated in beds, or whether they are only ſowed in equally diſtant rows, with the drill-plough.

" Such will likewiſe be the anſwer to this queſtion, if the reſult of theſe different experiments be conſidered. In the firſt place, we have thoſe of each field in particular; in the next, we have thoſe of ſome whole farms; and laſtly, we have thoſe contained in the table of the ſixth article, to which laſt I ſhall now limit my reflections.

" We may look upon the produce of 44 acres ſpread up and down a diſtrict of near thirty ſquare miles, amounting all together to 30940 pounds of wheat, as the medium produce of the generality of lands. I ſhall therefore not dwell upon the produce of each of theſe fields taken ſeparately, but only conſider now, that 44 acres yielded 30940 pounds of wheat.

" If theſe 44 acres had been cultivated in the old way, they certainly would not have produced ſo much, ſince we have ſeen that the medium produce is but three times the ſeed; and I am ſatisfied that it would have been leſs in this year 1754. However, I will ſuppoſe the crop to have yielded three times the quantity of the ſeed. Theſe 44 acres, ſown with 8926 pounds of wheat, would then have produced 26778 pounds; deducting from which 8926 pounds for the ſeed, the neat produce will be reduced to 17852 pounds.

" The 44 acres ſown with the drill-plough yielded 30940 pounds, from which we are to deduct 3839 pounds, which was all the ſeed that was ſown. The neat produce will then be reduced to 27131 pounds, which is 9279 pounds more than would have been produced in the old way.

" The owners or farmers of theſe 44 acres had therefore 9279 pounds of corn more. They reaped the firſt benefit of this gain, and the public the next, as ſo much more corn was carried to market than would otherwiſe have been. Such an advantage is very conſiderable, and deſerves the utmoſt attention of the public, whom we invite to conſider it in a more extenſive light. The object will thereby become the more intereſting.

" Let us but conſider how much more corn the whole of this ſpace of thirty ſquare miles would have produced, if all the arable lands in it had been ſown with the drill-plough: how much more grain would it not have afforded for the nouriſhment of the people! what increaſe of income to every individual concerned therein! and how ſure a way to guard againſt future dearths!

" But this is not yet all. Much greater advantages will ſtill reſult from the cultivating of lands entirely in the new way: I mean, by laying them out in beds, and obſerving all the practices of the new huſbandry. This I proved plainly in my journal of 1753, by the calculations of the articles II, V, and VI. This demonſtration is fully confirmed by the experiments of 1754, the products of which were greater, and their reſults ſtill more favourable to the new method.

" What has been already ſaid on this important ſubject, ſhews, what the neceſſary operations are, how eaſily they may be performed, and which are the points that merit moſt attention. The theory of the new huſbandry is now fully proved by experiments; and that great principle, the neceſſity of preparing the earth well by proper ſtirrings, ſo clearly demonſtrated, that it would be needleſs to inſiſt any longer on it.

" But the ſowing of the land, which is of the utmoſt importance to the ſucceſs of the crops, depends greatly on the time and ſeaſon when it is performed, and the care with which it is done.

We ſhall therefore give ſome obſervations on that head.

" The three moſt eſſential things which conſtitute a good ſowing, ſeem to me to be, next to the proper preparation of the earth, firſt, the time of ſowing; ſecondly, the choice of the ſeed; and thirdly, the due temperature of the ſeaſon, with reſpect to heat or cold, drought or wet; all which greatly influence the ſtate of the earth.

" With regard to the time of ſowing, I ſay, it is better to ſow early, than too late, provided the ſeaſon will admit of it. The plants are better able to reſiſt the ſeverity of the winter, after they have acquired a certain degree of ſtrength. There have been years in which fields ſown very late, for inſtance in December, have done extremely well: but that ought not to be made a general rule; experience ſhewing, that ſuch late ſowings very ſeldom anſwer.

" By too early ſowing, the corn is equally expoſed to other dangers. The ſtalks which ſhoot up before winter cannot well bear hard froſts, which would do no hurt to the wheat when but in blades. I obſerved, in the two laſt years, 1753 and 1754, that the firſt ſown wheat, which was attacked by the *ruſt* in autumn, was much more hurt by it than any other. Therefore I think the beſt time for ſowing, in ſuch a climate as Geneva, is, from the 20th of Auguſt, to the end of September. If, however, it ſhould not be practicable to ſow all the lands within that time, the firſt fortnight in October may likewiſe be taken in: but I would not adviſe this, except in a caſe of neceſſity. If all the land ſhould not be ſown within that time, I think one might expect a better crop by deferring to ſow it till ſpring. What I have been ſaying is more particularly applicable to land laid out in beds *.

" The ſame rules by which I judge of the proper time of ſowing here, may eaſily be adapted to other climates, in ſome of which the land will require being ſown earlier, and in others later.

" The choice of the ſeed is the ſecond thing, which to me ſeems to require more particular care than many may perhaps imagine. Every one certainly endeavours to chooſe the beſt wheat he can for ſeed; and it ought likewiſe to be very clean. Such corn is not difficult to be had, when reaped off the beds cultivated in our way.

" Though wheat ſo green that it had ſcarce loſt it's milky quality, ſprouted pretty well when I tried the experiment with it; I think it is more proper to ſow none but what is thoroughly ripe. The ſeed has then attained it's full perfection; and it is from that ripeneſs that we may moſt certainly expect the moſt vigorous plants.

" The wheat that has been reaped in a warm dry year, ſeems to me fitter for ſowing, than that which has been gathered in a cold wet year: for in ſuch a ſeaſon, all the productions of the earth are leſs good; their taſte is leſs ſavoury; and as that wheat in particular in which there is moſt moiſture is moſt difficult to keep, I infer from thence that the formation of it's grain muſt be leſs perfect. I ſhould therefore prefer wheat a year old, provided the year it was gathered in was warm and dry, to that which may have juſt been gathered in too rainy a ſeaſon. Accordingly, I al-

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* Repeated experience has taught us, that the ſame rule may be obſerved in this kingdom. Perhaps the colder the climate is, the earlier the wheat ſhould be ſown, that it may acquire the greater ſtrength to reſiſt the winter's cold, and ſhoot it's roots ſo deep into the earth, as not to be thrown out of it by froſts.

ways chooſe for ſowing, wheat of the growth of my high lands, rather than that which has been produced in flats.

" The benefit accruing from all this care, may, perhaps, not be extremely great; but at the ſame time it coſts nothing. Let us do in agriculture what is done in all manufactures: the very ſmalleſt profits, the very leaſt ſavings, are never neglected. Thoſe ſmall articles, often repeated, make large ſums in the long run, and are a real profit.

" There is another thing of greater conſequence, and of which I ſtrongly recommend the practice. It will not be attended with any expence. It is, by repeated experiments, always attended with the ſame ſucceſs, that I have found it to be extremely ſerviceable to the firſt ſprouting of the ſeed. Chance firſt made it known to me.

" I have often ſowed, purely to try what wheat was fitteſt for ſowing. I commonly ſowed wheat taken from the heap in the granary. I likewiſe frequently ſowed wheat picked out of the ears the moment before I ſowed it. I counted the grains of both ſorts exactly. Would any one think there could be any difference in the productions of theſe grains? yet I found a conſiderable one; what was picked out of the ears always roſe extremely well; ſcarce a grain of it ever miſſed: whereas numbers of thoſe which were taken from the heap, never ſprouted at all. I did not perceive this difference at firſt, but at laſt it ſtruck me: I relate the fact as it is, without pretending to account for the cauſe of this difference, which would lead me into too long a digreſſion. The experiment itſelf may be of real uſe. It ſhews us, that inſtead of threſhing the wheat intended for ſeed at any time, without diſtinction, it ought not to be threſhed till a very few days, at moſt two or three, before it is ſowed. A few hands will be able to ſupply the ſeedsmen with as much as they will want. This will not be attended with any ſort of expence, and may be the means of ſaving ſomewhat in the ſeed.

“ Perhaps too, this practice may be attended with a very valuable advantage. I have not indeed yet made the trials neceſſary to ſatisfy myſelf of the reality of what I imagine: but my deſire to be of ſervice to the public, induces me to mention it, that the lovers of agriculture may reflect upon it, and try ſuch experiments as will clear up my conjectures.

“ Threſhing the ſeed only juſt before it is ſowed, may poſſibly, in ſome meaſure, or perhaps entirely, prevent the firſt cauſe of the diſtemper called *ſmut*. By this I mean, that the ſeed which has not been mixed with ſmutty wheat, or any infected by it's black powder, will be exempt from this diſtemper. Not that I take that black powder to be abſolutely the original cauſe of this diſtemper: but I believe it very capable of commuicating it to grains otherwiſe ſound.

“ I wiſh that the multiplicity of my occupations may permit me to endeavour to clear up this matter, and to purſue my obſervations. If I can be ſo happy as to make any uſeful diſcoveries, I ſhall communicate them to the public.

“ That nothing may be neglected which can be of any ſervice to the ſeed, great care ought, in my opinion, to be taken in threſhing it; eſpecially in the manner which is commonly practiſed, with flails, upon the barn floor, or by trampling it with horſes. In either of theſe ways, a great number of grains are ſo bruiſed and hurt, that it is impoſſible they ſhould ever grow. If the wheat intended for ſeed, be not thoroughly dry and hard, the miſchief is ſtill greater; much more of it being then abſolutely cruſhed by the flail.

" As the new huſbandry requires much leſs ſeed, it will be the eaſier to execute an operation which might be too long and troubleſome to practiſe for ſo great a quantity as is uſed in the old way.

" The method which I adviſe, and which I myſelf have practiſed, is this: let one or two beams, two feet and an half, or three feet thick, be laid acroſs the barn floor: let the threſhers ſtand at each ſide of the beam, with a looſe ſheaf of wheat behind every man, from which he will take a handful at a time, and give it two or three ſtrokes againſt the beam: this will bring out a great deal of grain, which is to be reſerved for ſeed. Theſe ears may be bundled up again, and afterwards threſhed out with the flail for other uſes.

" This method is not ſo tedious as ſome may imagine: we are ſure that not a grain is bruiſed; the corns drop very readily out of the ears, eſpecially of wheat that has grown in beds: the great ſize of the grain helps to open the huſks, and thoſe are the moſt perfect grains which drop out in this manner. I think I may compare this operation with what is done in the making of wine. The firſt running is always the higheſt flavoured and beſt.

" Though the proper time for ſowing be come, the corn ought not to be put into the earth, if the temperature of the ſeaſon is not favourable. It ought, on the contrary, to be deferred in hopes of a change. If the weather is very hot, and the earth extremely dry, there will be an abſolute neceſſity of waiting till ſome rain has fallen. Without this precaution, the ſeed will riſe but very imperperfectly. I am ſure of it, by ſeveral experiments which I have made, and which contradict a common ſaying of our farmers, that the earth is the beſt granary to keep corn. Full of this notion, whenever the ſtated time comes round, they ſow, without diſtinction, in wet or dry land: even heat does not hinder them: they think their ſeed will certainly ſprout well after the firſt rain: but I have always experienced that the plants have come up thin.

" I tried an experiment purpoſely to ſatisfy myſelf whether one can ſow with ſucceſs when the weather is very hot, and the earth very dry. Upon reading Mr. Duhamel du Monceau's excellent treatiſe on the preſervation of corn, I obſerved that he had found by his experiments, that wheat which had been dried in a ſtove heated to ſixty degrees of M. de Reaumur's thermometer, had loſt it's faculty of growing.

" From thence I conjectured, that wheat which ſhould undergo a heat, for example, of thirty degrees, during a longer time, would be equally parched up, and rendered incapable of vegetating. I conſidered the earth, when hot and dry, as a kind of ſtove, in which the ſeed, if it remained too long, without receiving any moiſture, may become ſo dry, that the greateſt part of it will never be able to ſprout. I thought this reaſoning juſt, and therefore determined, in order fully to ſatisfy myſelf, to have recourſe to that truſty guide experience.

" On the eighteenth of July, 1754, at four o'clock in the afternoon, I placed M. de Reaumur's thermometer two inches deep in the ground, and ſcreened it from the immediate impreſſion of the rays of the ſun. The liquor roſe to the thirty-firſt degree, which ſhewed me the heat of the earth.

" The thermometer being afterwards expoſed to the ſun, the liquor roſe to thirty-ſix degrees.

" On the ſame day I ſowed 80 grains of wheat in this ground. The heat continued nearly the ſame during the reſt of that month, and almoſt all Auguſt. On the thirty-firſt of July, only 10 grains had ſhot up, and on the ſixteenth of Auguſt there were in all 16; after which, not one more roſe: conſequently 64 grains out of the 80 never ſprouted at all *.

" On the twenty-eighth of July I ſowed 50 grains. Only four of them roſe by the ſixteenth of Auguſt, and not one after. Here were again 46 grains which did not grow at all.

" On the ſame day, I ſowed 60 grains in another place. On the ſixteenth of Auguſt only ſix grains had ſprouted, and not one plant more ever appeared after: conſequently here too were 54 grains which never grew. All theſe grains were ſown in my garden, in exceeding good mould.

" I was ſure that the wheat which I ſowed was perfectly ſound, and in every reſpect capable of growing. It was therefore quite clear, that ſo great a number of grains out of the whole, which did not ſprout at all, had loſt the faculty of growing, by their being parched up by the heat and dryneſs of the earth. To be ſtill more certain of this, three weeks after I had ſown theſe grains, I watered half of them ſeveral times; but to no purpoſe: not one of them roſe, and I found ſeveral of them quite whole in the earth where I ſowed them.

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* M. Duhamel obſerves here, that wheat has, however, been known to riſe very well after having remained ſix weeks or two months in the earth. Perhaps the circumſtances were different.

" After this experiment, on the eleventh of Auguſt I ſuſpended the ſowings which I had begun on the eighth, and did not reſume them till the twenty-ſixth, after ſome rain which fell on the twenty-ſecond and twenty-third. Theſe laſt ſowings roſe much better than the firſt.

" Thus it is that experience and obſervation teach us to leave off bad cuſtoms, or ſuch as are not founded on principles with which a man of ſenſe can reſt ſatisfied.

" Whenever the produce of the fields on which my experiments were tried, is conſidered, it ought always to be remembered, that I uſed no dung on any of thoſe lands, and that they received no other improvement than what was owing to a better preparation of the earth, only by ſtirring it. Thoſe who chooſe to have recourſe to dung, will probably reap greater crops: with an hundred loads, they may dung three times more land than is done in the common way; for the dung ſhould be ſpread very thin, if one would have it be of any ſervice. By ſpreading it too thick, I believe the plants would grow too rank, and be apt to be lodged.

" The new huſbandry ſupplies the want of " dung, not only by ſtirring the earth, and not overburdening it with too many plants, *but likewiſe by the ſtrong thick ſtubble it produces, which affords a moſt excellent manure, attended with no expence.* It lies ready upon the ſpot; the plowing of the earth buries it; and as it is a long time in rotting, it helps to keep the ſoil looſe and light, and is repeated every year. I have found ſtubble almoſt whole at a year's end; and have ſeen ſome not quite conſumed at the end of two years.

" But can we be ſure that this manure is of any conſequence or real advantage? After what I have already ſeen of it's effects, I will venture to ſay, that it contributes greatly to increaſe the productions of the earth. I have very often plucked up plants remarkable for their beauty, and have frequently found their roots interwoven with tufts of ſtubble, which ſhewed me the cauſe of their extraordinary growth. I ſhall ſoon have more poſitive proofs of this, by the experiments which I am now making to clear up this point."

ARTICLE VIII.

Experiments made on beds ſown with ſix rows of wheat: compariſon of their produce, with that of beds ſown with only three rows; and ſome inquiry concerning the number of rows which it is beſt to ſow.

"IN the journal of 1753, Article VII, (p. 184,) I gave an account of my ſucceſs in ſowing beds with two turns of the drill-plough, in order to have ſix rows of wheat. It anſwered ſo well, that I thought there could be no hazard in ſowing a larger extent of ground in the ſame manner.

"This experiment ſucceeded equally well this year. I ſhall not enter into a detail of it, becauſe that would be only a repetition of what I ſaid on this ſubject in 1753. As to the reſult, the reader will recollect, that the ſame ground made into beds wide enough to be ſown with two turns of the drill-plough, which make ſix rows, produced more corn than if it had been ſown in beds with only one bout of the drill-plough, which would have made but three rows.

"With regard to the quantity of the products of the crops of 1753 and 1754, compared together, I have found that the ſix rowed beds produced this year very nearly the ſame as they did in 1753; excepting the field of the experiment, No.

VIII, (p. 170,) which yielded about half as much again as the year before.

“ Notwithſtanding the profit which I found in theſe experiments, repeated two years running, I do not think it adviſeable to enlarge the number of rows to ſo many as ſix. Five will, in my opinion, be very ſufficient ; and they may be made with one bout of the drill-plough, by giving it five ſhares, which is very eaſily done. This number of rows will be a proper medium between ſix and three.

“ Sowing in five rows will not, however, do in all ſorts of land. I believe it ſhould be practiſed in none but good ſoils, and that middling lands ſhould continue to be ſown with three rows at moſt.

“ I ſhall add farther, with reſpect to good lands, that they ought not to be ſown with five rows, till after they have been thoroughly well ſtirred ; and, above all, not till after the main furrow in the middle of the bed has been cut extremely deep, in order that the roots of the middle row, which is the moſt diſtant from the plowed alleys, may find a ſufficient depth of mould immediately under them, to ſupply them with their neceſſary nouriſhment.

“ But at the ſame time that a proviſion is made for the nouriſhment of the plants, care muſt be taken not to loſe too much ground, by making the alleys wider than they need be. My experiments have determined me to make my beds, for the future, about ſix feet wide. By leaving ſeven inches diſtance between each row, the five rows will take up about two feet four inches, and there will remain three feet eight inches for the breadth of the alleys. This ſpace is ſufficient for the plough or cultivator to work in with eaſe.

A R T I-

ARTICLE IX.

Experiment made in order to know which is the moſt profitable way of ſowing the beds, and to aſcertain more preciſely the quantity of ſeed proper to be uſed, in order to have the greateſt crop.

"THE title of this article divides it naturally into two parts, which I ſhall treat ſeparately.

"It is of great conſequence to know which is the moſt profitable way of ſowing the beds; I mean, that by which they will be ſtocked with a proper number of plants: for when too much ſeed is ſown, the plants hurt one another; and when too little, the earth is not enabled to produce ſo much as it is capable of doing.

"The buſineſs therefore is, to determine what number of plants would be moſt advantageous. Fortunately, the difference is wide enough between the too great, and the too ſmall number; and the produce of the crops cannot be diminiſhed but by an exceſs one way or the other.

"But whatever certainty we may acquire with reſpect to this intereſting point, we cannot flatter ourſelves that we ſhall always be able to keep to it in our practice: The various accidents to which corn is liable, from the hour of its being ſown till it is reaped, will always fruſtrate the methodical arrangement which we may have intended to give the plants.

"The difficulty of ſucceeding in this inquiry ought not however to diſcourage us; for it would be attended with ſuch advantages, as would make very ample amends for all the labour beſtowed upon it. Let us then have recourſe to experiments. Thoſe that are made with this view, will never be quite uſeleſs. If they do not lead us to the very thing we are in ſearch of, they may at leaſt diſcover to us others which may be of ſervice.

"According to our principles, the diſtances between plants ought to be equal throughout the whole length of the rows, that all of them may have an equal quantity of earth from which to draw their nouriſhment.

"Several experiments have ſhewn, that ſix inches is not too great a diſtance for the plants to be at from each other. In this caſe, it would be ſufficient to ſow one grain of wheat at every ſixth inche. According to this diſpoſition, a field well prepared ought to produce the greateſt crop. The plants will very commonly branch out ſo as to have 20, 30, or 40 ſtalks: I have had ſome with upwards of 80. 'Tis pity that this exact diſtribution of the ſeed cannot ſubſiſt long. The accidents which I met with, ſoon convinced me, that it was neceſſary to increaſe the quantity of the ſeed, and that very conſiderably.

"However, this does not yet hinder me from thinking, that if any eaſy method could be found, to have a plant of wheat exactly at every ſix inches diſtance in the rows, it would be the beſt way of ſowing. I have often conſidered how this could be reduced to practice, as well to ſatisfy my curioſity, as that I might be the better able to proceed in my operations. When a theory is known to be good, one is ſtrongly encouraged to draw all poſſible advantages from it for the practical part: one then proceeds with confidence and pleaſure.

"Experience having convinced me that it never would be poſſible to have a plant at every ſix inches in each row, by ſowing only a ſingle grain of wheat at thoſe diſtances; it naturally followed, that the way to have the ground better covered with plants was, to ſow more grains. The next queſtion was, how many grains ſhould be ſown in each place: ſhould it be two, three, or more? Experience only could clear this doubt. I therefore tried the following experiment. I ſowed a different number of grains in cluſteas, 6 inches diſtant from each other, putting one grain in the firſt, two in the ſecond, and ſo on to the ſixth, which had ſix grains: then I began again, and went on as before, till the whole length of the row was ſowed in this manner. The produce of each cluſter was to ſhew me whether it would be beſt to double, triple, or quadruple the ſeed, which it was plain had been ſown too thin, when only a ſingle grain was dropt at every ſix inches.

"The winter of 1753 was already far advanced when theſe thoughts firſt occurred to me. It was then too late to try this experiment with wheat: but, that I might not looſe a year, I did it in the ſpring with barley; not doubting but that corn, which is uſually ſowed in March, might furniſh me with ſome uſeful hints for the culture of that which remains longer in the ground.

"Accordingly, on the ninth of April, 1754, I ordered another bed to be ſowed with barley, in my preſence, and in the manner I have juſt related. I counted all the grains of each cluſter myſelf. They were ſown in three rows. I varied the experiment in the row next to the ſouth, by ſowing no cluſters there of leſs than 3, 4, 5, or 6 grains; and this I continued during the whole length of that row. At harveſt, all the cluſters in which ſeveral grains had been ſown, were ſo thick, that they touched one another.

"What is of moſt conſequence to our culture, is, to know the produce of each cluſter. The annexed table ſhews it particularly. I ſhall only add, that the cluſters, as they are here ranged under their reſpective numbers, occupied forty feet in length, and that the beds were five feet wide."

EXPLANATION

Of the table of the bed ſowed in cluſters with barley, and it's product.

FIGURE I.

" The ſouth row has 24 numbers.

FIGURE II.

" The middle row has 16 numbers.

FIGURE III.

" The north row has 16 numbers.

" Theſe numbers are ſubdivided into ſmall ſquares, in the upper ones of which are the number of grains ſowed in each cluſter.

" The lower ones contain the number of ſtalks bearing ears, which each cluſter produced.

" Each number contains an equal number of ſmall ſquares, and under each number of each of theſe ſquares, is ſet down the number of grains that were ſown: thoſe of 4 cluſters have 18 grains; thoſe of ſix, 21.

" The cyphers in ſome of the lower ſquares of fig. II. and III. are the places were no plant grew.

RESULTS.

" *The SOUTH ROW*,

ſowed with	6,	5,	4, and	3 grains,
produced	661,	624,	447, and	493 ſtalks.

In all 2225 ſtalks.

" *The*

“ *The MIDDLE ROW,*

ſowed with 1, 2, 3, 4, 5, and 6 grains
produced 48, 72, 147, 204, 219, and 487 ſtalks.
In all 1177 ſtalks.

“ *The NORTH ROW,*

ſowed with 6, 5, 4, 3, 2, and 1 grains,
produced 502, 372, 345, 276, 200, and 92 ſtalks.
In all 1787 ſtalks.

“ Conſequently the whole number of ſtalks in the three rows was 5189. They yielded 17 pounds of grain, beſides a great quantity that was ſhed in reaping.

“ On the footing of this crop, an acre would contain at leaſt 44 beds five feet wide, which was the breadth of the bed on which this experiment was made. The beds would be 222 feet long: the produce of one of them would be 93 pounds 8 ounces, and that of the 44, 4138 pounds 8 ounces; that is to ſay, near nine quarters to the acre: a very conſiderable crop; and which might be carried ſtill much farther by other experiments of this kind, as we ſhall ſoon ſee.”

REMARKS.

“THE following obſervations deſerve the reader's utmoſt attention. Firſt, By this experiment, I have very near effected what I aimed at, *viz.* to have two or more plants grow ſo cloſe together as to ſeem but one; and that at ſix inches diſtance from each other. If the three rows had been joined together lengthways, they would have been 120 feet long, and ought to have contained but 240 plants: but the diſtances, which were marked by gueſs, not being exactly ſix inches each, 96 cluſters were ſown in each row, which made 16 cluſters over and above. By this means, ſeveral of them were nearer than ſix inches to each other.

" Two hundred and eighty-eight cluſters were ſown, all of which produced plants, except 25 which did not ſprout, or of which the plants periſhed. This deficiency is not very conſiderable: but we muſt obſerve, 1. That almoſt all the places where this happened had been ſown with only one or two grains of wheat: 2. That it was in the middle row that the greateſt number of plants was wanting: 3. That the ſouth row, in which the ſmalleſt quantity ſown for any one tuft was three grains, furniſhed and retained it's full number of plants: and laſtly, that almoſt all thoſe which were next to the vacant ſpaces, were ſtronger than the reſt, and thereby made amends for the loſs of the others.

" Secondly, The whole number of the ſtalks amounted to 5189, which is after the rate of 43 ſtalks and a quarter to a foot: but it is much more conſiderable in the ſouth row, which having produced in all 2225 ſtalks, the proportion is 55 and a half to a foot. The cauſe of this difference is eaſily ſeen. The expoſition of that row to the ſouth, being more favourable than that of the others, may have contributed thereto; but it is very plain that it was chiefly owing to this farther circumſtance, that none of the cluſters in that row were ſown with ſo few as one or two grains.

" Thirdly, We ſee that the increaſe of the ſtalks was, in general, in proportion to that of the ſeed; only the cluſters which were ſown with three grains in the ſouth row, produced 46 ſtalks more than thoſe which were ſown with four grains; but ſtill the general reſult of the three rows remains exactly in the ſame progreſſion, as appears by the following recapitulation."

"RECAPITULATION.

Stalks produced by 1 *grain.*	140
2 *gr.*	272
3 *gr.*	916
4 *gr.*	996
5 *gr.*	1215
6 *gr.*	1650
Total	5189

" Fourthly, The ears were nearly equal, at leaſt in two thirds of the length of the rows: the other third ſurpaſſed the reſt, as will appear by the following extract of the twelve firſt numbers of the South row.

No.	*produced*	*ſtalks.*
1		87
2		122
3		91
4		99
5		82
6		66
7		78
8		100
9		87
10		116
11		148
12		68

" Fifthly, The difference between the produce of the cluſters ſown with one and with ſix grains, is extremely great. The former produced but 140 ſtalks; the others multiplied to 1650. It is true that the number of the cluſters of ſix grains is greateſt; which is ſome diminution of the difference.

"Sixthly, I obſerved ſeveral ſtalks from which others had ſhot out, all as ſtrong, and as long, as thoſe from which they derived their origin. They proceeded from the firſt joint above the ſurface of the earth, generally at the heighth of three, four, or five inches; and were two, three, and ſometimes four in number. I never perceived this kind of tillering before; but had, till then, always obſerved it to be at the neck, or point of ſeparation between the roots which deſcend, and the ſtalks which aſcend, that the plants branched out.

"Seventhly, I ſuſpected, in the ſummer, what was the cauſe of the great vigour of the plants of this experiment: but I ſaw it much plainer after harveſt: for, upon pulling up ſome of the tufts of ſtubble, I found their roots innumerable. This fact is ſtrictly true. I could not count them upon any one plant that had more than 15 or 20 ſtalks. Theſe roots were in ſuch bundles, and ſo confuſedly interwoven one with another, that, after counting ſeveral hundreds of them, I was forced to give up the taſk. Their length and thickneſs was anſwerable to their number.

"I muſt now remind the reader of what I ſaid before, that the ſeveral accidents which I met with in my firſt experiments ſhewed me it was neceſſary to increaſe the quantity of the ſeed. I did ſo, by ſmall degrees, from year to year. It is equally important for the ſucceſs of the new culture, not to run into another extreme by loading the earth with more plants than it can nouriſh: the crop would be conſiderably diminiſhed thereby.

" It appears by this experiment, that the cluſters which were ſown with ſix grains did not hurt one another: on the contrary, their being ſown in that manner proved an advantage, ſince they produced much more than the others: from whence it follows, that one may, without danger, extend the quantity of the ſeed beyond the limits of the principles of the new huſbandry. The principles themſelves are not the leſs true; though the farmer is at liberty to uſe his own diſcretion in the application of them, according to the nature of his ſoil.

" Thoſe principles, which ſuppoſe that every plant is to ſubſiſt till harveſt, reduce the ſeed to a very ſmall quantity: but numbers of accidents deſtroy many of them. Our reaſon ought conſequently to tell us, that, without deviating too much from the principles which we adopt, we may, and ſhould, judiciouſly ſtock our land with a ſufficient number of plants, in order to guard againſt unavoidable accidents.

" Still I may be aſked, what is that ſufficient quantity? I anſwer, that our experiment ſhews that ſowing ſix grains together in a cluſter, from ſix to ſix inches, all the length of the rows, will not be found too thick. By following this rule, one may be almoſt certain that the whole ground will be ſtocked with a proper number of plants. However, this is to be looked upon only as a general propoſition, from which it will often be very proper to deviate in the circumſtances we are going to mention:

" *When the ſowing ſeaſon is favourable.*

" *When the land is well prepared.*

" *In countries where the winter ſeldom is ſevere.*

" *When the land is but little liable to inſects.*

" *When the land is not in danger of being hurt by too much drought, or too much wet.* And laſtly,

" *When the land is good and very fertile.*

" In

BED ſown with three Rows of Bar

Fig. I. SOU

	No. 1.				2.				3.				4.				5.					
Number of Grains ſown .	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5
Number of Stalks produced	44	15	13	15	37	33	32	20	30	30	24	7	32	19	40	8	38	16	15	13	14	11

	No. 13.				14.				15.				16.				17.					
Number of Grains ſown .	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5
Number of Stalks produced	14	3	16	34	28	47	19	27	20	21	19	22	25	39	9	32	36	22	7	17	16	15

Fig. II. MI

	No. 1.						2.						3.						4.			
Number of Grains ſown .	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4
Number of Stalks produced	0	2	4	10	18	13	0	0	5	17	30	59	0	0	6	18	7	5	4	0	5	27

	No. 9.						10.						11.						12.			
Number of Grains ſown .	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4
Number of Stalks produced	0	23	9	10	14	23	9	3	2	14	10	36	12	0	16	17	16	5	6	0	20	3

Fig. III. N

	No. 1.						2.						3.						4.			
Number of Grains ſown .	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3
Number of Stalks produced	8	26	10	24	18	8	21	36	17	12	15	0	52	21	13	4	16	11	46	47	32	0

	No. 9.						10.						11.						12.			
Number of Grains ſown .	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3
Number of Stalks produced	71	25	25	7	24	0	50	36	13	23	0	3	24	28	17	13	19	15	2	0	36	18

Barley, in Cluſters, and its Produce.

UTH ROW.

6.				7.				8.				9.				10.				11.				12.			
6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3
14	11	33	8	15	38	16	9	37	30	18	15	20	27	22	18	28	52	8	28	35	47	26	40	25	20	6	17

18.				19.				20.				21.				22.				23.				24.			
6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3
16	15	7	20	18	21	6	11	33	23	13	33	17	17	11	25	32	14	7	21	32	17	54	13	35	47	26	40

IDDLE ROW.

4.				5.						6.						7.						8.					
3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
5	27	0	18	1	9	14	23	33	44	0	0	18	6	20	21	1	13	18	0	19	36	2	5	19	31	19	28

12.				13.						14.						15.						16.					
3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
20	3	18	34	3	3	0	7	3	48	0	10	10	3	0	62	6	4	9	4	3	28	4	0	2	14	9	27

NORTH ROW.

4.				5.						6.						7.						8.					
4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1
32	0	0	13	37	20	21	38	0	2	7	7	31	23	30	6	20	11	12	25	21	1	32	32	16	8	5	10

12.				13.						14.						15.						16.					
4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1
36	18	5	4	34	33	20	35	27	0	43	44	52	3	8	4	16	2	7	26	16	3	39	5	23	17	4	12

" In all theſe, and other ſuch like caſes, leſs ſeed ſhould be ſown ; and, in the contrary caſes, more. Prudence, and a careful ſtudy of the nature of the ſoil, ought to be our guides. Two or three years experience will be ſufficient to ſhew us the practice which will anſwer beſt.

" It will be right to repeat our laſt mentioned experiment, and even to vary it. In all probability it will afford us ſtill greater lights. It will be right, for example, to ſow the cluſters with a greater number of grains, beginning with ſix, the produce of which is known, and going on to ſeven, eight, and even more, always in cluſters, till one comes to a number at which the crop ceaſes to yield an equal profit. By this means the two extremes, either of too much or too little ſeed may be known ; and the juſt proportion will then eaſily be determined.

' Some farther alterations may likewiſe be made in this experiment. For example, I placed the grains in the earth ſo that they touched one another. I will try to place them at ſome little diſtance from each other, and to range them in a kind of circle, of about three inches diameter. It is reaſonable to think, that the plants may make a greater progreſs then, as they will not all have one common centre : ſome of them will be nearer to the plowed alley; their roots will reach it more eaſily than before, and will multiply there; which may render the plants more vigorous.

ARTICLE X.

General diſpoſition for the farther progreſs of the new huſbandry, and particularly for the crop of 1755.

"IT is with uncommon ſatisfaction that we ſee the trials of the new huſbandry multiply daily. A great number of intelligent perſons have ſown part of their lands in equally diſtant rows, with the drill-plough, for the next harveſt. We have already ſeveral farms, and among them ſome conſiderable ones, in the neighbourhood of Geneva, which are no longer ſown any other way.

"It is much to ſee this new method thus readily entered into. Thoſe who follow it, will ſoon begin to take a pleaſure in calculating, and will be curious to compare the new crops with the old. Theſe calculations will inſenſibly lead to others, on the produce of lands laid out in beds. They will ſee, that there can be no hazard in making a few trials. Thus it is, that ſeveral have been determined to cultivate ſome of their lands this year in beds.

"That theſe arguments ſhould have their full weight with men capable of reaſoning, is not to be wondered at: but I confeſs I have been agreeably ſurpriſed, to find this conviction extend to people who can ſeldom be prevailed upon to leave their beaten track. Some peaſants in theſe parts ſent a meſſenger this winter to tell me, that they began to have a good opinion of my method; that they were aſtoniſhed at the beauty of my young plants, the like to which they had never ſeen before; and that, if they continued do well, and met with no accident, I ought to have a prodigious crop. After this preamble, he continued, ſaying, that he was directed to beg of me to give him the particulars of my experiments; for that ſeveral of his neighbours had agreed to meet, in order to read them over in the winter, and to make their little reflections upon them. He concluded with adding; "I believe we ſhall all agree to ſow in equally diſtant rows with the drill-plough; and perhaps too "we may, by and bye, lay our lands out in "beds."

"This conduct of the peaſants ſeemed to me ſenſible and prudent. I gave them the experiments of 1753, and ſent them word, that both my advice and my drill-plough were at their ſervice; and that it ſhould not coſt them any thing, if they choſe to make a trial of it. They have been well ſatisfied with what they have read, and ſeem diſpoſed to accept of my offers.

"I have experienced this year, more than ever, the facility with which lands are cultivated in the new way. No part of the farm where I ſometimes make a little ſtay, is any longer cultivated after the old method. The moſt troubleſome part is now over: my lands were ſown in a favourable ſeaſon; the plants roſe extremely well, and flouriſhed perfectly till the beginning of winter; but the ſeverity of the froſts has proved fatal to many parts of my fields, and will certainly be a detriment to my crops."

Continuation of M. DE CHATEAUVIEUX's *Experiments in the years* 1755 *and* 1756.[e]

"MY lands were cultivated in 1755, in the ſame manner as in the preceding years. I therefore ſhall not enter into any detail upon that ſubject. When I ſowed my fields, they were well prepared to receive the ſeed; the ſpring was pretty kindly; and towards the end of autumn my corn was very fine, excepting ſome ſpots that were attacked with the *ruſt* ſo early as the tenth of November: other places, in which the plants were ſtrong and healthy, promiſed a moſt plentiful crop; and though it was greatly diminiſhed by the winter's froſts, it proved, upon the whole, ſufficient to confirm the advantages of the new huſbandry, which have been already proved in my former accounts.

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[e] DUHAMEL, *Culture des Terres, Tom.* V. p. 416, *2e Edit.*

" The winter of the year 1754, was extremely ſevere. The froſt, which was exceſſively intenſe, laſted a long time, and killed a prodigious number of plants: thoſe that reſiſted it, loſt ſome of the branches they had ſhot out in the autumn before, and the plants ſo weakened branched but little in the ſpring. The evil would have been infinitely greater, if the ground had chanced to be full of water, when thoſe exceeding hard froſts came on: but luckily it was not very wet.

" This winter was followed by a very dry ſpring, uncommonly hot, and conſequently unfit to recover the corn. The ſummer, in which there was ſcarce any rain or dew, but very frequently ſultry ſcorching heats, exhauſted the plants in ſeveral fields. I was not ſurpriſed at it. The ſeaſons were extremely unfavourable to the productions of the earth; and, to add to the misfortune, a vaſt quantity of worms did likewiſe conſiderable damage to the corn.

" However, my wheat roſe; the ſtraw was pretty near as long as in the preceding years, and the ears were well filled with grain. The plowings had been well performed, which kept the earth in a ſtate of moiſture; leſs indeed than in 1754, becauſe but very little dew fell in 1755.

"The wheat cultivated in the old way yielded but few ſheaves: the ſtraw was ſhort; the ears were very full of grain; and, in general, the quality of the corn was excellent.

"There was room to expect good ſucceſs from the lands that were ſown in 1755, for the crop of 1756. The young plants roſe extremely well, the ground had been properly prepared, and had the degree of moiſture neceſſary to promote their growth.

"Though ſome ſlight froſts were felt towards the latter end of October, they did not prevent the growth of the corn, the cold abating from the twelfth of November, to the end of that month. M. de Reaumur's thermometer was, during that time, at from ſix to eight degrees above the freezing point. At the ſame time we had pretty frequent, and often plentiful ſhowers of rain.

"The corn was in very good condition at the beginning of the winter, during which there was ſcarce any froſt, excepting the ten firſt days of December, when the thermometer fell to about ſix degrees below the freezing point. During the months of January and February, it was pretty conſtantly above the freezing point: we had little ſnow; but pretty frequent rains.

"The ſpring and ſummer of 1756 having been extremely rainy, and the earth too much ſoaked thereby, the plants were poor, and the ſummer plowings could not be performed. For this reaſon, I could give ſeveral of my fields but one ſtirring, and others had two. I would not plow whilſt the earth was ſo very wet: for that would only have hardened, and as it were kneaded it; and I judged that ſuch bad plowings would have been equally prejudicial to the corn then growing, and to the preparation of the fallow for the next ſowing. I found afterwards that I had done right.

“It could not but be expected that ſo unfavourable a ſeaſon would prove fatal to the corn. I had obſerved during all the month of April, in which there was not any froſt, and the thermometer was from five to ſeven degrees above the freezing point, and towards the end of that month from nine to twelve degrees, that the corn made but little progreſs, and grew yellow. The diſtemper continuing to increaſe, I perceived in May, that the corn was attacked with what we call *the rickets*[*]. The bad ſtate of the roots of theſe plants, the colour of their blades turned to a blueiſh green, and yellow at the point, left no room to doubt what ailed them; and from that time it was eaſy to foreſee that the crop would certainly be ſcanty, not only on account of the ſmallneſs of the number of ſtalks which the plants had produced; but alſo, becauſe their ears would have but little grain.

“In June, the healthy plants throve greatly: the ſtraw grew long: but yet the ſheaves did not yield ſo much grain as in the foregoing years, by about a fifth part, as nearly as I could judge. The corn was very fine and very clean; and had it not been for this accident, I am confident that the crop would have been very plentiful.

“I did not ſee any one field exempt from this diſtemper. Exceeding fine corn, cultivated in the old way, was totally infected with it; and the ſheaves in general yielded but about half the quantity of grain that they uſually do in good years. Theſe grains were very ſmall, and mixed with a great many ſeeds of weeds.

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[*] This will be deſcribed hereafter, among the other diſtempers of Corn.

“ Theſe general notions are neceſſary, in order to form a right judgment of the reſult of my experiments, which I ſhall relate in the following order.

“ The firſt article will comprehend the experiment which I made upon all the fields I laid out in beds, the laſt of which now bore their third crop. I have diſtinguiſhed them by the ſame numbers as in the former years, and ſhall add to each of them the particular obſervations which relate immediately to it.

“ The ſecond article will ſhew the produce of the lands ſown in equally diſtant rows, with the drill-plough. I ſhall make ſome reflections upon the uſefulneſs of this practice, which is certainly always preferable to the common way of ſowing.

“ I ſhall prove in the third article, that it is ſtill more profitable to lay the land out in beds. This proof will reſult from the calculations and compariſons of the produce in each different method.

ARTICLE

ARTICLE I.

Experiments made on fields laid out in beds, the laſt made of which have borne three ſucceſſive crops. Theſe fields are diſtinguiſhed by the ſame numbers as in the foregoing years. Obſervations relating particularly to each experiment.

EXPERIMENT, No. I.

YEAR 1755.

N. B. *This was made on the ſame piece of ground as my firſt experiment in 1751: and this year's crop was the ſixth, without any interruption.* (See p. 125, 133, 155, and 196.)

"I Gave a very full account, in the ninth article of the year 1754, (p. 254,) of the experiment I made in order to be the better able to judge which is the moſt profitable way of ſowing the beds; and to determine what quantity of ſeed it is moſt proper to ſow, in order to have the greateſt crop; and this I called, *ſowing in cluſters, at the diſtance of ſix inches from the centre of the one to that of the other.* I ſhall only remind the reader here, that the ſpot of ground which was ſowed in cluſters, with barley, in the ſpring, was part of a bed, forty feet long, and that the produce of the grain was ſeventeen pounds weight, beſides a conſiderable quantity which was ſhed in reaping.

" This experiment, which deſerved to be repeated, was tried again the ſame year, and upon the ſame ground which I had ſowed with barley. This laſt grain being reaped, I ſowed the ſame bed with wheat, on the twenty-third of September following: but it is to be obſerved, that I did not plow this ſpot after the barley was off, but only plucked up the ſtubble, and made three channels, into which the ſeed was dropt by hand in cluſters ſix inches aſunder.

"As the cluſters ſown with ſix grains, in the experiment of 1754, were thoſe which produced the moſt ſtalks and grains, I ſowed all the cluſters now with at leaſt ſix grains, ſome with ſeven, and others with eight; keeping all the grains at ſome little diſtance from each other. The bed forty feet long contained eighty three cluſters in each row, which were ſown with two ounces ſix penny-weights of wheat."

"The plants came up very well: I ſpared no pains to cultivate them; they throve wonderfully till harveſt: their blades, ſtalks, ears, and grains, were very fine; and I preſerved them from the birds with a net; but as I would not reap them till they were thoroughly ripe, a great deal was ſhed in cutting them down, and they yielded me but 28 pounds of corn."

OBSERVATIONS.

"THIS experiment is a farther confirmation of the reſult of the firſt which was made in 1754; *viz.* that ſix grains are not too great a number to be ſown in a cluſter, ſix inches diſtant from the next cluſter. I had not leiſure to count the ſtalks which each cluſter produced; but the 28 pounds of corn which they yielded ſeems to be a ſufficient proof.

"The circumſtance of not plowing the bed before it was ſowed, confirms the advantages of preparing land according to the new huſbandry.

"I ſaid, that the ſtubble was plucked up, in order to prepare the bed for being ſown. This ſhewed me how much ſtubble helps to enrich land.

"When this bed was ſowed, and the corn ſprung up, I ordered the furrows which were made before winter, next to the outward rows, to be opened for about half the length of the bed, and the ſtubble to be put into them, and covered over with earth: conſequently it was laid in the ground which was cultivated, and in that part of it where the plants were to extend their roots. As the quantity of roots collected there was pretty great, I concluded that the effect of the ſtubble ought to be much more viſible in that place, than it can be in fields where the plowman buries it as chance directs. In effect, that part of the bed became much finer than the reſt; the plants produced a greater number of ſtalks; and there is no room to doubt that the ſtubble was an excellent manure."

YEAR 1756. N°. I.

"I PURPOSED to continue ſowing this bed in cluſters, and to increaſe the quantity of the ſeed, in order to ſee what the effect would be: but, in hopes of better ſucceſs, I gave up the thoughts I once had of reaping a third crop from this bed without plowing it.

"After one plowing, I ſowed it, on the ſixteenth of September, 1755, in three rows of 93 cluſters in each row, and 10 or 15 grains in each cluſter: and, in order to place them with ſome kind of regularity, I made uſe of an iron hoop, about three inches in diameter, which was laid upon the ground at each ſpot intended to be ſowed, and the grains were dropt at nearly equal diſtances, ſome round the inſide, and ſome in the middle of this circle. Each cluſter was ſowed in this manner.

The ſpace from one centre to another, was about five inches. The ſeed was covered over lightly, with a rake, and the quantity employed in this operation was 5 ounces 12 penny-weights.

" This wheat was always very fine, from it's firſt riſing till harveſt. It was reaped on the 31ſt of July, and yielded twenty-three pounds of grain."

OBSERVATIONS.

" THOUGH the produce of this bed was leſs now than in 1755, I did not think this difference ought to be imputed to the increaſe of the quantity of ſeed ſown; becauſe the plants were as ſtrong as could be wiſhed for, their ſtraw was as long as in the former years, and their ears were as large: but I obſerved, that this bed had not been quite free from ſickneſs, and that it contained a pretty conſiderable number of rickety plants, which yielded but little grain.

" It reſults from this experiment, that a certain quantity of ſeed is neceſſary, to counterbalance the many accidents to which corn is perpetually liable.

" Though this bed might have yielded a greater quantity of grain in a more kindly year, yet it's produce, even in this, was very conſiderable: for if we reckon in proportion the produce of an acre, it would yield 3795 pounds (nearly 8 quarters) of grain, produced by 56 pounds 10 ounces of ſeed: which is after the rate of 67 for 1.

" To this it will be objected, that though a ſmall ſpot of ground, like that we have been ſpeaking of, was made to produce ſo conſiderable a quantity of corn, it would probably not be poſſible to obtain ſuch a crop in proportion from an extent of ſome acres of land.——It may be ſo: but ſuppoſing the crop to be even greatly inferior, it would ſtill be much more conſiderable than the common crops.

" Let us examine this queſtion more minutely. It is of great conſequence not to embrace an opinion, and eſpecially a diſadvantageous one, before it has been carefully conſidered. Let us ſee then to what the diminution of the crop may be owing. I ſay nothing of the particular accidents which may in general leſſen crops: but ſuppoſing all things equal, in ſuch an extent of ground, my opinion is, that the firſt and eſſential cauſe of the miſcarriage can be imputed only to the cultivator himſelf, who ſees what is beſt to be done, but neglects it; and who ought at leaſt to endeavour, as much as he poſſibly can, to do that in great, which he ſees ſucceed ſo well in ſmall.

" I grant that many reflections and reaſonings, which ſeem at firſt ſight to be extremely appoſite, are in reality oftentimes only ſpecious and deceitful, and that it is always right to recur to experimental proofs. Luckily we have ſuch ready to produce.

" The celebrated Wolfius obſerved long ago, that the productions of plants which grow in large pieces of ground, are always fine when the ſeed has been properly buried, and ſowed thin: whence he concluded, that the moſt extenſive fields ought to produce as much in proportion as ſmall ones, and that it is evident that whenever an experiment has been made with the neceſſary precautions, and has ſucceeded upon the tenth part of any piece of ground, it ought to ſucceed equally upon two, three, or four tenths, and conſequently upon the whole of that ground.

" The experience of five years, of which I ſhall give an account in the following article, will, I believe, prove this very ſufficiently."

EXPERIMENT, No. II.

N. B. *This field is marked with the ſame number in the former experiments.*

For the crop of 1752, (p. 137,) *it was ſowed with* 11 *pounds* 4 *ounces of wheat, which produced* 1041 *pounds* 12 *ounces.*

For the crop of 1753, (p. 156,) *it was ſowed with* 34 *pounds* 14 *ounces, which produced* 1575 *pounds.*

For the crop of 1754, (p. 204,) *it was ſowed with* 61 *pounds* 14 *ounces, which produced* 1820 *pounds.*

For the crop of 1755, *it was ſowed with* 78 *pounds, which produced* 1950 *pounds.*

For the crop of 1756, *it was ſowed with* 51 *pounds, which produced* 1885 *pounds.*

YEAR 1755.

"I HAD now cultivated Smyrna wheat for ſome years, ſowing the whole of each year's produce, in order to increaſe my quantity ſo as to be able to ſow a pretty large field with it; which I could not compleat till 1754, for the crop of 1755.

"The field in queſtion was ſowed with 78 pounds of this corn. It roſe very well: but towards the end of winter, I was ſurpriſed to find that a great quantity of plants had been deſtroyed by the froſt; and I ſoon perceived, that almoſt all the ſtrongeſt and healthieſt plants were thoſe of common wheat, and that there were very few of Smyrna wheat. I had obſerved at the time of ſowing, that there was ſome mixture in the ſeed: and as I had ſome of the ſame ſort, ſtill remaining, I was able to ſatisfy myſelf that there was a third part of common wheat in the Smyrna wheat which

I had ſown; and that it was the former which grew ſo fine, and of which almoſt the whole crop conſiſted.

"This ſhews that Smyrna wheat does not reſiſt hard froſts: but at the ſame time, ſuch winters as that of 1754, very ſeldom happen in this country. This field was reaped on the nineteenth of July; the common wheat was thorough ripe, and the Smyrna wheat quite green, though it's grain was grown very hard.

"I ſeparated the ears of Smyrna wheat from the others, in order to bind them up in diſtinct ſheaves, that I might have their grain pure and unmixed. This field produced 213 pounds of Smyrna wheat, and 1737 pounds of common wheat; in all 1950 pounds; which is a greater crop than that of the preceding years."

Obſervations on Smyrna wheat.

"MY former crops of this wheat, though the quantity was but ſmall, had already ſhewed me plainly that it produces more grain than any other kind. In 1755, the ſheaves of this wheat, of the ſame ſize as thoſe of our common wheat, yielded more grain by half than the others did. It is therefore probable, that the planting of this grain will be attended with advantage, eſpecially in climates not ſubject to too hard froſts.

"But a point of very great importance, is, to know well at what degree of maturity this corn ſhould be reaped. In the two firſt years that I ſowed any of it, the ears were prodigiouſly large, and full of very plump well-fed grain; but I was uneaſy at not ſeeing them ripen. They continued green, whilſt I daily expected that they would turn yellow, and the grains grow hard; but in vain. By this delay, the grain waſted ſo much, that I never ſaw any ſmaller, nor ſo much ſhrunk as theſe.

However, they ſprouted well when ſowed, and produced very fine plants.

"The third year, I determined to reap them earlier than I had done the firſt. Accordingly, I cut them down as ſoon as I found that the grain had acquired a ſufficient degree of hardneſs, notwithſtanding that the corn was ſtill quite green. The conſequence of this was, that the grain remained exceeding plump and fine."

YEAR 1756.

"I CONTINUED to ſow the ſame field with Smyrna wheat, of which I procured ſome quite pure and unmixed. I ſowed fifty-one pounds of this wheat on the firſt of October. The plants were fine, and ſufficiently forward before winter, and throve prodigiouſly from ſpring till harveſt. But I ought not to omit obſerving, that Smyrna wheat is as apt to be *rickety* as common wheat, and that numbers of theſe plants were affected with that diſtemper.

"This crop was reaped on the twenty-ninth of July, whilſt it was yet green, and the grain only hardened. It yielded 1885 pounds of exceeding fine, clean, good ſized wheat."

OBSERVATIONS.

"IT would be needleſs to make experiments, if the inſtructions which they may afford were not to be attended to: but as thoſe inſtructions will ſometimes eſcape the notice even of the moſt careful obſerver, it is proper always to repeat the experiments, and to continue them conſtantly for ſome time. It is by ſo doing, that the advantages of the new huſbandry will appear in their true light, and be eſtabliſhed beyond diſpute.

" The field I am now ſpeaking of, and from which I reaped five crops in five ſucceſſive years, preſents us real and very conſiderable advantages, which I ſhall ſet forth in what appears to me the juſteſt and moſt ſtriking manner.

" To this end, I ſhall ſtate exactly the products of the field in queſtion, cultivated in the old and in the new way. I ſhall begin with it's produce during ſixteen years that it was cultivated according to the rules of the old huſbandry: namely, from the crop of 1730, to that of 1744 incluſively. In this ſpace of time, it produced eight crops; the cuſtom of the country being to ſow but once in two years, and to reſt the ground each alternate year. My account may be depended upon, as perfectly exact. I have extracted it out of a journal kept by a ſteward of mine, who died in 1745, and who was ſcrupulouſly exact even in the ſmalleſt concerns.

" After giving the produce of this field, the ſoil of which is very good and ſtrong, during ſixteen years that it was cultivated in the old way; I ſhall ſhew what the ſame field produced in five years cultivation according to the new method, in order to compare the different products of only five years with thoſe of ſixteen; and afterwards draw a compariſon between both the cultures for ſixteen years, ſuppoſing, which is a great diſadvantage, that the eleven remaining years of the new huſbandry produce no more than theſe firſt five have done."

Number I.

“ *Produce of the field Number* II, *during ſixteen years that it was cultivated in the old way*; viz. *from the crop of the year* 1730, *to that of the year* 1744, *incluſively*.

SOWED.

		Pounds.	Pounds.
In 1729.			267
1731.	Wheat Barbary wheat	425 63	488
1733.	Wheat		441
1735.	Wheat		504
1737.	Engliſh wheat		441
1739.	Wheat		441
1741.	Wheat		472
1743.	Wheat mixed with tares		504
	Total ſeed of eight years		3558

REAPED.

		Pounds.
In 1730.		1134
1732	A year extremely bad, on account of the great quantity of ſlugs which deſtroyed the wheat, and the many ſeeds of weeds intermixed with it.	1606
1734.		1953
1736.		1008
1738.		977
1740.		1291
1742.		1638
1744.		1512
	“ Total amount of the crops of 8 years, in the ſpace of 16 years	11119

“ Brought

" Brought over; Total amount of the crops of 8 years, in the ſpace of 16 years . .	11119

To be deducted.

	Pounds.	
Siftings of 1732	756	
* Siftings of the other years	1009	
Seed, as above	3558	
		5323
" Remains, for the neat produce of 16 years,		5796

" * *This field always produced clean corn, greater pains being taken to keep it free from weeds, than could be beſtowed upon other pieces of ground, more diſtant or more extenſive. The ſiftings would otherwiſe have been more conſiderable in ſo many years.*

Number II.

" *Produce of the field Number* II, *during five years of culture in the new way.*

S O W E D.

	lb.	oz.
In 1751. Wheat	11	4
1752. Wheat . . .	34	14
1753. Wheat . .	61	14
1754. Smyrna wheat . .	78	
1755. Smyrna wheat . .	51	
" Total ſeed of 5 years	237	0

R E A P E D.

	lb.	oz.
In 1752.	1041	12
1753.	1575	
1754.	1820	
1755.	1950	
1756.	1885	
" Total amount of the crops of five years,	8271	12
" To be deducted for the ſeed, as above,	237	

There was no ſifting.

Remains

	lb.	oz.
“ Remains for the neat produce of the five years	8034	12

Number III.

“ *Compariſon of the above produce of the new culture with that of the old.*

	lb.	oz.
“ The new huſbandry produced in five years, without any intermediate year of reſt,	8034	12
“ The old huſbandry produced in 16 years,	5796	
“ Conſequently the new huſbandry produced in five years, more than the old did in ſixteen, . . .	2238	12

Number IV.

“ *Farther compariſon of the produce of the new huſbandry with that of the old, as above.*

NEW HUSBANDRY.

	lb.	oz.
“ The new huſbandry produced in five years,	8034	12
“ Suppoſing the crops to be to the ſame for 11 years more, they would amount to	17676	7
“ And for 16 years, to . .	25711	3

OLD HUSBANDRY.

“ The neat produce of the old huſbandry, in ſixteen years, was . . .	5796	
“ The balance in favour of the new huſbandry would conſequently be, in ſixteen years	19915	3

Reflections and Obſervations.

"I DARE to ſay that very few of thoſe who might juſt have glanced over the products of the five years during which the field No. 2. was cultivated in the new way, would have imagined the advantage to be near ſo great as it really is, had not the above compariſons been likewiſe laid before them. If nothing but the hope of great profit can recommend the new huſbandry to the general practice of our farmers, the above calculations ought at once to determine them; ſince they here ſee that the ſame field produced much more grain in five years, and even in four, when managed in the new way, than it produced before in ſixteen years, whilſt cultivated according to the old method. I confeſs that when I firſt began to practiſe the new huſbandry, I did not expect ſo great advantages. They might have been greater ſtill, if I had not committed in the firſt years, faults which conſiderably diminiſhed the crops of 1752 and 1753. Beſides thoſe firſt faults, I committed another, which greatly leſſened my crops. I was not aware that *the fertility of every field which is plowed deeper than it has uſually been, is often leſſened for ſome years, unleſs it be aſſiſted by a ſufficient quantity of manure.* The new earth which is brought up to the ſurface by theſe plowings, remains ſo hard and compact, that it cannot be fit for the nouriſhment of plants, till after it has been well broken by repeated plowings, and as it were ripened by the influence of the air, *&c.*

"This obſervation will be particularly uſeful to all beginners in the new huſbandry. They muſt not be ſurpriſed if their firſt crops do not anſwer their wiſhes: but the deeper they plow at firſt, the greater ſucceſs they may juſtly expect afterwards.

wards. In the mean time they muſt ſuffer patiently the inconvenience I have been ſpeaking of, or remedy it by uſing a great deal of manure.

“ Would it be reaſonable to deſire greater advantages than thoſe we have proved above ? any man of ſenſe may ſurely be ſatisfied with them: But through what fatality does it happen, that infinite numbers will not or cannot ſee them ? I know, for inſtance, that, excepting a certain number of perſons who have ſtudied the new huſbandry thoroughly, or practiſed it with care, it is generally thought in this country, that the field No. 2. which I have been ſpeaking of, has produced me leſs corn than it would have done if it had continued to be cultivated in the old way. Whence does this notion ariſe : Surely from this, *that men are apt to judge too precipitately, without examining ſufficiently, or calculating right.* Whoever really wiſhes to be informed, and deſires to promote the public welfare, and his own private good, may eaſily attain theſe ends : but it muſt be by a different road from that which is commonly purſued : it muſt be by reckoning and calculating, as I have done with regard to the field in queſtion.

“ Some fields will not yield ſo much as this has done : but yet their produce will be ſuch as muſt determine all unprejudiced perſons in favour of the new huſbandry, as I ſhall demonſtrate by the calculations in the third and fourth articles.

EXPERIMENT, No. III.

“ N. B. *The field on which this experiment was made, contains about an acre and a half of ground. I have joined it to that of the experimemt No.*VII, *under which it's produce is included.*

EXPE-

EXPERIMENT, No. IV.

	Sowed		lb.	oz.		lb.	oz.
In	1753		181		reaped	3370	
	1754		268	14		4972	8
	1755	1ſt half	488			5850	
		2d half	488			2080	
	1756		816			3640	

YEAR 1755.

"ONE half of this field was laid out in beds in 1753, (p. 165,) and the other half, not till 1754, (p. 207.) I ſhall begin with the oldeſt, from which I ought to expect the beſt crop, as that ground was the beſt prepared. It was ſowed on the 27th and 28th of Auguſt, with 488 pounds of wheat. This was a conſiderable increaſe of ſeed. I judged it neceſſary, and ſo it proved; for it preſerved this field from being greatly hurt by the froſt in winter, which deſtroyed a great number of plants. If they had not been ſo thick ſown, I make no doubt but that the crop would have been conſiderably diminiſhed. This half was reaped on the 18th of July, and yielded 5850 pounds of very fine grain. Here is a crop conſiderably greater than the former. It exceeds the firſt by 2480 pounds.

The other half of this field now bore it's ſecond crop. The ſame quantity of ſeed (418 lb.) was ſown, but did not produce ſo much as in the other half. As this part lies in a bottom, the froſt hurt it more than it did the other, nor had it been ſo long laid out in beds; beſides which, the rains hindered me from ſowing it at the ſame time as the other half. It could not be ſowed till the 21ſt, 22d, 23d, and 24th of

October, which is ſomewhat late. It was reaped on the 19th of July, and yielded 2080 pounds of wheat.

YEAR 1756.

“ THIS field was ſowed on the 9th, 10th, and 12th of September, with 816 pounds of wheat, and reaped on the 28th and 29th of July. The produce was 3640 pounds.

OBSERVATIONS.

“ ONE might juſtly be ſurprized at the ſcantineſs of this crop, if, beſides what I ſaid before of the general cauſes which were ſo prejudicial to the crops of this year, I did not add thoſe which may have more particularly affected this field. My intention was to ſow it thicker than it chanced to be; through the fault of the ſower, who did not follow my directions. The hurt might perhaps not have been great, if the ſeaſons had proved kindly: but it was of conſiderable conſequence this year, and particularly in this field, in which all the corn was extremely *rickety*.

EXPERIMENT, No. V.

	Sowed		lb.	Reaped lb.
In	1753	(p. 168,)	139	2205
	1754	(p. 207,)	224	2283
	1755		388	2600
	1756		544	2700

YEAR 1755.

“ THIS field ſtill continued to be difficult to bring to good tilth; and therefore required the more ſeed. It was ſowed on the 29th of Auguſt, reaped on the 29th of July, and produced 2600 pounds of grain.

YEAR 1756.

" I Thought it neceſſary to continue to increaſe the ſeed of this field. It was ſowed on the 20th and 22d of September, with 544 pounds of wheat. The young plants looked very fine before winter, and promiſed better than thoſe of the preceding years. The general accidents of the year affected them. They were reaped on the 26th of July, and yielded 2700 pounds of corn.

EXPERIMENT, No. VI.

Sowed.		lb.	Reaped lb.
For 1753	(p. 169,)	45	724
1754	(p. 210,)	82	798
1755	wheat	126	900
	barley	12	nothing
1756	beans and tares	153 : value in wheat	780

YEAR 1755.

" THIS field is one of thoſe in which the ſtiffneſs of the ſoil reſiſted longeſt that degree of pulveriſation in which the chief merit of the new huſbandry conſiſts. The firſt crops were not conſiderable. In 1754, I could not ſow this ground before the 15th of October, and yet the plants which it produced were very fine. It was reaped on the 21ſt of July, and produced 900 pounds of wheat.

" The moſt remarkable thing in this field, was what happened to ſome beds which I had ſowed with 12 pounds of barley. The young plants were exceeding fine in autumn, but the hard froſts of the winter killed every one of them.

"As ſoon as I perceived this loſs, I endeavoured to repair it, by ſowing the ſame beds again with ſpring barley: and as the two wheat beds next to them had likewiſe ſuffered ſo much as to have but few plants left, I ſowed them alſo with barley.

"Theſe beds were ſowed without being plowed again. The whole charge of this ſecond ſowing conſiſted in paſſing the drill once over them, and in 28 pounds of barley which was uſed for the ſeed. This was done on the 8th of April.

"This barley grew very fine. It was reaped on the firſt of Auguſt, and yielded 270 pounds of grain. I doubt whether that which was ſowed before the winter, could have produced more: ſo that I think this crop made me ample amends for the loſs of my firſt ſeed.

"How great a proof is this of the excellence of the new huſbandry! and how eaſy a means does this huſbandry afford, of guarding againſt dearth, when our young crops chance to be deſtroyed, by the facility with which the ſame lands may be ſown again, without loſs of time, and with ſcarce any more expence than the bare coſt of other ſeed, which, in ſuch times of general diſtreſs, will produce crops of other uſeful grains, even more profitable than thoſe of wheat! An ineſtimable advantage, which ſecures the ſubſiſtence of the people, and which cannot be obtained by the old huſbandry. This muſt be evident to every one who conſiders that all that is requiſite, in ſuch a caſe, in the new husbandry, is only to ſow again; whereas in the old way, the husbandman is obliged to plow before he ſows, to ſow a great deal of ſeed, and to harrow that ſeed in after it is ſown. The vaſt ſaving made in the ſeed, in the new way, is likewiſe another very important article in a time of ſcarcity.

"I reaſon here upon a ſuppoſition of the total loſs of all the crops of wheat; which really was the caſe in 1709.

YEAR 1756

"I Reſerved this field in order to ſow it in the ſpring, with the grain of that ſeaſon, with which I had not yet made any experiment, except in ſmall ſpots of ground. I plowed it before winter: the new beds were well made, and the earth was in ſuch fine tilth in the ſpring, that I thought I might ſafely ſow it without any farther plowing. Accordingly I did ſo, on the 26th of April; the too great wetneſs of the earth not permitting it to be done ſooner. One half of this field was ſowed with beans, and the other half with tares; in all, 153 pounds of both; which produced a crop equal in value to 780 pounds of wheat.

OBSERVATIONS.

"THIS year was extremely bad for all grains ſown in the ſpring: moſt of which yielded but the value of the ſeed: ſo that the produce of this field, compared to that of others cultivated in the old way, ought to appear very conſiderable.

"The ſucceſs of this experiment ſhews, that when too much rain, or too great drought hinders plowing the land in due time, and ſome fields cannot be prepared for wheat in the autumn, they may be ſowed in the following ſpring, with the different grains uſually planted in March.

EXPERIMENT, No. VII.

	Sowed.	lb.	Reaped lb.
For 1753	(p. 169,)	412	2646
1754	(p. 210,)	360	2467
1755	including the experiment, No. 3.	639	4290
1756		1010	6760

YEAR 1755.

"THE ſoil of this field is of ſuch a nature as to require a greater quantity of ſeed than many others. I ſhall doubtleſs be thought to have increaſed it conſiderably, in having enlarged that quantity to 639 pounds: and yet this year's experiment makes me judge, that it will ſtill be neceſſary to ſow more another time.

"I ſowed this field on the 9th, 10th, and 26th of Auguſt, and reaped it on the 16th and 17th of July. It yielded 4290 pounds of grain.

YEAR 1756.

"I Have a meadow adjoining to this field. I plowed up part of it, which had produced but very little graſs for a long time, and turned it into arable land. This addition ſerved to replace another part of the field, which I ſowed with lucerne. This laſt part being leſs than that which was added from the meadow, the field may have been enlarged about two acres, and the ſoil is much the better for it.

"This field was ſowed with 1010 pounds of wheat, on the 10th, 13th, and 15th of September, and was reaped on the 23d and 24th of July, when it produced 6760 pounds of corn.

EXPERIMENT, No. VIII.

	lb. oz.		lb.
For 1754 were ſown (p. 217,)	76 8;	which yielded	1462
1755	157		1300
1756	230		2080

YEAR 1755.

"THIS great increaſe of the quantity of ſeed might be wondered at, if I did not obſerve that this field was ſowed with two bouts of the drill-plough; by which means each bed (for they were all wide enough to admit of it) had ſix rows of plants inſtead of three, and conſequently took up double the quantity of ſeed. The event will ſhew that I was right in ſo doing.

"The field was ſowed on the 31ſt of Auguſt, with 157 pounds of wheat. Nothing could make a finer appearance than this corn did at the beginning of winter. The plants, which had already branched very abundantly, made the ground look ſurpriſingly thick covered. The ſtrength of the ſtems, and the deep green of the blades, made me expect extraordinary ſucceſs. They continued thus promiſing during all the winter; and the ſame in February and March, and to the middle of April.

"The ſoil of this field is excellent: but it could not be preſerved from the fatal effect of the ſevere froſts in winter. I was extremely ſurpriſed when, going thither on the 27th of April, I found this wheat, which I had ſeen twelve days before without the leaſt ſympton of decay, reduced to a moſt deplorable condition: not a ſingle ſtalk remained that was not dead, nor a blade that was not withered. Both the ſtalks and the blades adhered ſo little to the plants, that one might rake them up in heaps, like graſs that has been mowed: in ſhort, nothing could be more melancholy than the appearance of this field.

"The earth was extremely dry, and the weather very hot for the ſeaſon: from the 16th to the 24th of April, M. de Reaumur's thermometer was always, at ſeven o'clock in the morning, at from 15 to 18 degrees above the freezing point. I am apt to think that this uncommon temperature of the air compleated what the hard froſts had begun, and which I did not perceive before.

My firſt thought was, to ſow the field again with barley, as I had done in the caſe of the experiment, No. VI: but ſeeing that the diſaſter was general, I examined moſt of the plants with great attention. I ordered the earth to be dug, and found ſome plants quite dead, and others, in pretty great number, which had ſtill ſome vigour, and were provided with very good roots, and of which only the ſtems and blades had periſhed. This gave me ſome hope; which was not a little ſtrengthened by my perceiving that ſeveral of theſe plants were ready to produce new ſhoots, ſome of which could juſt be diſtinguiſhed by their white point, ſcarcely perceptible; others were about the 12th part of an inch long, and others a quarter or half an inch: theſe laſt began to look green.

"Several reaſons induced me to think that theſe plants might ſtill be ſtrong enough to produce new ſtalks, eſpecially if a little rain ſhould chance to fall. I therefore reſolved not to ſow this field again. Fortunately, a good ſhower of rain fell on the 29th, which did them wonderful ſervice. I went to ſee them ſoon after, and found the new ſhoots conſiderably grown: upon which I determined to cultivate the beds with care. By the middle of May, the plants were grown very fine,

were

were loaded with blades and ſtalks, and only ſeemed much thinner than in the autumn: the ſtraw was as long, and the ears were as big, and as full of grain, as the year before. I was obliged to reap this corn early; becauſe, as the heat of the weather had precipitated the ripening of the grain, it might have ſhrunk and ſhrivelled if I had let it ſtand ſome days longer. It was cut down on the 17th of July, and yielded 1300 pounds of grain.

"I am perſuaded that this accident diminiſhed the crop by above half; and this is certainly the reaſon why it produced leſs than that of 1754.

"The ſhape of this field was irregular on the north ſide. The length of the beds in that part decreaſed progreſſively, ſo that thoſe next the end were not above three or four fathoms long. This made the tilling of them very troubleſome, becauſe of the frequent neceſſity of turning the plough. I ordered this triangular part, which was about a third of the field, to be plowed for ſowing in equally diſtant rows with the drill-plough. The reſt was preſerved in beds, as in the preceding years.

"I ſowed it on the 17th of September, with 230 pounds of wheat, which was reaped on the 24th of July, and yielded 2080 pounds of grain.

EXPERIMENT, No. IX.

	lb.	oz.		lb.
For 1754 was ſowed (p. 217,)	249	12;	which yielded	2925
1755	312			1362
1756	295			2219

YEAR 1755.

"THIS field, which had been well prepared, was ſowed on the 27th of Auguſt, with 312 pounds of wheat, which grew very fine and thick till November: but from the 10th to the 18th of that month, a general *ruſt* ſeized it. I imputed to this diſtemper the ſmallneſs of the crop, which amounted only to 1362 pounds.

YEAR 1756.

"THE ground was extremely well prepared, and better than in the preceding years. It was ſowed on the 24th of September with 295 pounds of wheat, which produced 2219 pounds. It was reaped on the 21ſt of July.

EXPERIMENT, No. X.

		lb.		lb.
For 1754 (p. 218,)	was ſowed	294;	which yielded	3055
1755		397		2210
1756	- rye	348		2700

YEAR 1755.

"THIS field was ſowed on the 30th of Auguſt, with 397 pounds of wheat, which produced 2210 pounds. I make the ſame remarks on this experiment, as on the preceding, No. IX, year 1755.

YEAR 1756.

"THOUGH it is not uſual for me to ſow rye, becauſe all my lands are fit to bear wheat, I was willing to make a trial with that grain; and accordingly I ſowed this field with it, on the 16th of September. The quantity employed was 348 pounds. The ſtraw was very long, and much thicker than that of rye in the common way: the grains alſo were conſiderably larger. It was reaped on the 19th and 20th of July, and yielded 2700 pounds of grain.

EXPERIMENT, No. XI.

Performed by the ſame perſon who made thoſe of 1754, *marked with the ſame number*, (p. 224,) *and thoſe of* 1753 *marked No.* IX. (p. 172,)

" THOUGH the following extract does not agree exactly with the title of this article, I was unwilling to make it a ſeparate one. It contains very intereſting details: the moſt eſſential circumſtances are related with great preciſion; and the conſequences of the reſults are eſtabliſhed by very inſtructive calculations. They ſhew the writer of them to be a ſtudious huſbandman, a very ſkilful naturaliſt, a zealous lover of the public good, who inſtructs by his example, and ſtill more by his knowledge.

" Theſe experiments were made about fifteen miles from Geneva, in a country where it is the cuſtom to ſow the land two years running. The firſt year, it is ſowed with wheat; the ſecond, with ſpring corn; and the third, it is reſted.

Extract of a letter to M. de Chateauvieux, *dated December 7th*, 1755.

" I received the journal of your laſt year's ex-" periments, and have read it with very great " pleaſure. If it were poſſible for me to make " any obſervation of the leaſt importance, upon " your experiments, which had eſcaped you, I " ſhould take the liberty to lay it before you, in " full confidence of your receiving it kindly.

" In general, I aſcribe, as you have done, the " different ſucceſs of the new huſbandry, 1. To

" the intrinſic quality of the ſoils, ſome of which " ſeem unfit for the production of wheat: 2. To " the condition of the lands, when they firſt began to be cultivated in the new way: 3. To " the manner in which they were prepared according to the principles of this huſbandry: " and laſtly, to the quantity of ſeed that was " uſed.

" I was particularly pleaſed with your experiment on the barley. It is certainly very inſtructing, and confirms what I before ſuſpected, " that, in our climate, wheat and other plants " love ſociety; and that they thrive better when " numbers of them are planted together, than " they would do ſeparately, provided that number " be not too great. You will cetainly not fail to " repeat that experiment in years leſs hot and leſs " dry, and upon other plants. Still I am afraid " that no fixed rule can ever be given with regard " to the quantity of the ſeed: too many circumſtances influence the condition of the ſoil: but " it will always be of great ſervice to fix certain " bounds, within which every one may chooſe " what ſuits him beſt.

" You will ſee by the account of my little experiments, that I have ſowed in the ground of " my rows, nearly what would have been ſowed " by hand in the ſame ſpace. But the imperfection of my drill-plough, and the condition of " my land, obliged me ſo to do; and I have not " hitherto found any inconvenience from it.

" I ſhorten my reflections, and proceed to my " experiments.

Produce

Produce of the firſt and ſecond crop of a field cultivated in the new way.

" THIS field contains, according to our mea-
" ſure, ſix *poſes*, which are equal to very near four
" acres and a half. The ſoil of it is tolerably good;
" rather light than ſtrong; fitter for rye than
" wheat. I am the firſt that ever ventured to ſow
" it with wheat. Dung uſed to have a great effect
" upon it for the firſt crop, but the ſecond ſeldom
" ſucceeded: in ſhort, it was the general opinion,
" that nothing could be made of this field without
" the help of a deal of good manure.

" It was well dunged in 1749, and ſowed with
" maſlin corn. The year 1750 was very favourable
" to corn in general, and particularly to that of this
" field. It yielded as much as two middling crops;
" that is to ſay, ten for one: but being ſowed
" again the ſame year, it yielded, in 1751, but two
" and a half for one. The year 1752 was the year
" of reſt, or rather it was plowed that year, ac-
" cording to the old method, and ſowed in the
" broad-caſt way, but without dung. The autumn
" was not kindly: the plants roſe poorly; and the
" crop of 1753 yielded ſcarce three for one, after
" deducting the tythe. It was after this crop that
" this field was laid out in beds of ſix feet wide,
" and ſowed the ſame year with wheat. As the
" mould of theſe beds could not be prepared pro-
" perly, and the year 1754 was but a poor one for
" wheat, I was not ſurpriſed at the ſcantineſs of
" the crop. I ſowed twelve of our meaſures, and
" reaped ſeventy-two. Our meaſure of wheat
" weighs, when it is good, twenty eight pounds;
" and that of maſlin, twenty-ſix pounds. I did
" not weigh mine every year; but I am ſure it was
" always full weight.

“ Encouraged, rather than diſheartened, by this “ trial, I plowed theſe beds up for a new crop, and “ ſowed them, part with maſlin corn, and part “ with wheat.

“ The ſummer of 1754 was ſo dry, that I de- “ ferred plowing the ſummit of the beds which “ had borne their crops, till the end of autumn. “ This was attended with theſe two inconvenien- “ cies: firſt, that the intermediate earth, which “ had been well pulveriſed, being no longer ſup- “ ported as before, ſlipt away from under the drill, “ and ſpread to the right and left; by which means “ the plants had leſs depth of good mould left, “ and I loſt part of the advantage I hoped for “ from this culture. The other inconvenience “ was, that the beds being no longer ſo high raiſed “ as they ſhould have been, the firſt plowing in au- “ tumn covered their outmoſt rows in ſeveral “ places: a loſs, by ſo much the more conſiderable, “ as the rows ſo buried would, by their ſituation, “ have otherwiſe been the fineſt of all. I certainly “ under-rate it, in valuing it at only a tenth part “ of the crop.

“ As maſlin is a much quicker grower than “ wheat, and being uncertain whether it could do “ without dung; out of eighteen beds, I dunged “ twelve, but very ſlightly; juſt as I would have “ dunged the third part of this ground, if I had “ intended to ſow it in the broad-caſt way.

“ I ſowed it on the fourth and fifth of October, “ 1754, with two turns of the drill-plough, and “ very thick, by reaſon of the imperfection of my “ drill, and becauſe the ſeaſon was already ſome- “ what advanced. A third more ſeed was ſowed “ this year than laſt, *viz.* eighteen of our mea- “ ſures.

“ The plants roſe well, the rows looked very “ thick and well filled, except thoſe which were "hurt by the firſt autumnal plowing, and by cattle which broke in upon the ground, and did a deal of damage.

"The plants in the part which had been dunged, were very fine all the winter. In the beginning of April they grew with ſurpriſing vigour, and were as beautiful as could poſſibly be in May and June. They were ſo tall, that they hid my plough and horſes, and ſeemed to promiſe three times more than the other plants where the ground had not been dunged. Theſe laſt grew more ſlowly: but juſt before harveſt, they puſhed ſtrongly; and if their ſtraw was not ſo long or ſo thick as that of the former, there was ſcarce any difference in the length of the ears; and the difference of the produce was but one fourth in favour of the dunged plants.

"Both the one and the other ſuffered on the 23d of May, by a violent north-eaſt wind, which broke a great number of the ſtalks of the rye, and tore others up by the roots. The ſtalks that were not quite broken, recovered perfectly, and the loſs was not great with reſpect to them. The caſe was different in regard to the plants that were broke aſunder or torn up. I reckoned the damage ſuſtained by theſe laſt, equal to a tenth part of the crop.

"Of the forty-ſeven furrows of this field, eighteen ſowed with maſlin yielded me (excluſive of the tythe, which is an eleventh part) ſixty of our meaſures. This grain is the fineſt of it's kind in the whole country, and is equal to the common wheat. The meaſure weighed, in the drieſt and coldeſt ſeaſon, twenty-ſeven pounds; which is a ninth part more than the weight of the common maſlin.

"The twenty-nine furrows ſowed with wheat ſeemed to have eſcaped the violent froſts of the winter: but I was greatly ſurpriſed in April, to "ſee large ſpaces in which the plants periſhed "daily; and others wherein the wheat ſeemed to "have diſappeared, to make room for a prodigi-"ous quantity of ſenvy, which looked extremely "well*.

"I was not at all pleaſed with this change of "crop: yet, though I no longer expected "any thing from theſe damaged places, which "amounted to the value of nine furrows, I would "not give up the good plants which I thought "might ſtill be in them; and therefore ordered "them to be weeded carefully, ſeveral times "over, by women who deſired only the weeds for "their labour. This operation was not uſeleſs: "the ſurviving plants gathered new ſtrength: they "branched conſiderably in June; and yielded me, "at harveſt, about a third part of what I reaped "from the places which had not been damaged. "Theſe laſt ſeemed but indifferent during all the "ſpring. Every one judged this corn inferior to "that of the fields which had been ſown in equally "diſtant rows and dunged: but, from the begin-"ing of June, when the other wheat began to de-"cline, my rows throve ſo well, that ſome parts "of them were very greatly ſuperior, both in the "length of the ſtraw, and the bigneſs of the ears, "which laſt were every where longer and better "filled.

"Notwithſtanding all this, my wheat had ſtill "more to ſuffer. It was cut juſt before the heavy

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* Great part of this field ſeems to have ſuffered exactly the ſame accident as happened to the whole field of the experiment No. VIII. It was not perceived in either of them, till April; and the effect was the ſame upon the plants in both caſes, though they were more affected in one than in the other. In both caſes too, the plants recovered and yielded a good crop.

" rains in July, and ſome of it ſprouted, as was " the caſe elſewhere. Beſides the loſs in the quality of the grain, my threſhers reckoned that the " quantity of it was diminiſhed eight meaſures. " The whole produce was but ſixty-eight meaſures " after deducting the tythe.

" I have entered into this detail, in order to make " the following remarks.

" 1. As this field, twelve furrows excepted, was " not dunged ſo early as in the year 1749; the " ſuperiority of the crop of 1755 over that of " 1754, muſt be imputed chiefly to the new huſbandry. The places on which my fineſt wheat " grew, were not at all extraordinary in 1754, and " yet they were not dunged for 1755: conſequently " the culture, far from exhauſting, meliorated the " ground.

" 2. Some ſoils are fitter to produce ſome grains " than others; and it is vain to attempt to force " nature. Notwithſtanding the good culture, the " bad part of my field was yet worſe than in 1754; " but the ſenvy in it was finer. I ſowed this part " with graſs, which ſtill covers it, and is very " green and vigorous. I judge that radiſhes or " turneps would do very well there.

" 3. One muſt not always judge of a crop, by " the appearance of the green corn in April and " May; becauſe the dung then exerts it's greateſt " ſtrength for the production of the blades, and " that appearance is oftentimes deceitful.

" 4. The laſt plowings ought, if poſſible, never to be neglected: it is to them that I aſcribe " the favourable change which happened to my " wheat.

" To follow your method, I have now only to " compare the produce of this field, with what it " yielded when cultivated in the old way. I have

" not been able to find it's exact produce before the " year 1750. All I know, is, that the crops varied " extremely, according as the ground had, or had " not been dunged, or the year was more or leſs " kindly.

" I ſhall therefore eſtimate the produce of this " by that of the neighbouring fields, which are " thought to bear a good crop, when a *poſe* of " land yields thirty-two of our meaſures, after de- " ducting the tythe and ſeed-corn. The next crop, " whether it be of winter or of ſpring corn, is ſel- " dom worth half the firſt: however, ſuppoſing it " to be ſixteen meaſures, as the land is reſted the " third year, the neat produce of the crop for three " years will be forty-eight meaſures; which is ſix- " teen meaſures a year, and ninety-ſix meaſures for " the ſix *poſes*.

" I had, in the new way, 128 meaſures of wheat " and maſlin; deducting from which 18 meaſures " for the ſeed, there remain neat 110 meaſures, " and a profit of 14; for which I am indebted to " the new huſbandry.

" If we add to this, the eight meaſures loſt by " the ſprouting of the grain, and the damage done " by the plowing in autumn, it will appear that, " without thoſe two extraordinary accidents, I " ſhould have had 35 meaſures more than could " have been expected in the old way, and that of " a corn, which, ſuppoſing all other things equal, " is worth 12 *per cent.* more than any of the com- " mon growth.

" I make no doubt but that if I were to lay " in my furrows the dung that is ſpread yearly " upon my lands, and were to take all the precau- " tions neceſſary to ſow and cultivate them pro- " perly, the neat produce would be thirty mea- " ſures, one year with another; which would be " a continual plenty.

“ However that may be, thus much is certain
“ in favour of the new huſbandry, that, notwith-
“ ſtanding all the accidents, my field produced the
“ ſecond year about double the quantity that it did
“ the firſt.”

Firſt year's produce of a field ſowed and cultivated according to the new huſbandry.

“ THIS field contains about three acres and a
“ half. It was divided into beds five feet wide,
“ which were ſown alternately with one and with
“ two bouts of the drill-plough; that is to ſay,
“ with three rows and with ſix. The plowings
“ had been but badly performed, and the beds
“ were not raiſed or arched ſo high as they ſhould
“ have been. Thoſe that were ſown double, that
“ is with ſix rows, were always ſuperior to the reſt.
“ As the ſoil of this field is generally ſtrong, and
“ fit for wheat, it did not afford the ſame variations
“ as the former, though ſome of this wheat
“ ſprouted.

“ I ſowed 17 meaſures, and reaped 92, beſides
“ the tythe. By the ſame calculation as before, the
“ neat produce was one meaſure leſs than in the
“ old way.

“ But it is to be obſerved, 1. That by the
“ ſprouting of the grain, I loſt more in this field
“ than in the other. 2, That this was not a good
“ year for wheat. 3, That this field, being bor-
“ dered by two highways, and not being incloſed,
“ was greatly damaged by cattle that got into it.
“ 4, That what grain I did reap was clean, and
“ ſuffered ſcarce any diminution by ſifting. 5,
“ That if I had ſowed all my beds with ſix rows,
“ I ſhould probably have reaped a fourth part more:
“ ſo that no blame ought to be imputed here to
“ the new huſbandry. 6, That it is the firſt year
“ of

"of my trying this huſbandry; that my ground "had been but very imperfectly prepared; and "that it is now in a much better condition for the "next crop, though my ſervants have again com-"mitted ſeveral blunders. All theſe conſidera-"tions ſeem to me farther proofs of the excellency "of the new huſbandry.

"I could prove that, in point of profit, this laſt "field has yielded me three times as much as it "uſed to do in the old way, and the other field "twice as much.

"This may more than ſuffice for ſuch ſmall ex-"periments as mine. I could wiſh that they had "been greater, and the ſucceſs more complete. "With what pleaſure ſhould I offer them to you, "whom I look upon as the chief and patron of all "who follow the true principles of agriculture!"

"Though I have ſowed the bad parts of the "firſt field I ſpoke of with graſs, I have added "three *poſes* more to the arable, againſt next year, "in order to cultivate them in the new way; which "I purpoſe extending to all my lands the next "ſowing ſeaſon.

"I have, very injudiciouſly, I doubt, ſowed "between twelve and thirteen *poſes* with grain "which had ſprouted. I do not believe the third "part of it has come up; but as I ſowed thick, "and my lands are much better prepared than "they were laſt year, I hope to have at leaſt as "good a crop."

OBSERVATIONS.

"WHEN experiments have been repeated in different places, the circumſtances attending them ought to be greatly conſidered: for if theſe have been alike, and the event is the ſame, they ſerve to eſtabliſh one another, and merit our confidence in them. The compariſon of the laſt experiments, with mine, gives me room to make two important obſervations. The firſt is, that both of us have perceived, and for the ſame reaſons, the neceſſity of ſowing a greater quantity of ſeed than we did in our firſt experiments. This augmentation produced better crops. We may therefore now lay down, as a rule founded on experience, that the quantity of the ſeed muſt be what we ſaid in our laſt accounts, regard being had to the particular conſiderations mentioned therein.

" The ſecond obſervation is, that both of us have ſowed beds with two bouts of the drill-plough, that is, with ſix rows of corn : and the event in both caſes has been, that the ſame extent of ground has always produced a greater quantity of grain. It is therefore probable that this method will be found to be the beſt.

" But as it is poſſible that the effect may not be the ſame in different countries, a trial may be made by ſowing ſome beds with three rows, and others with ſix, and which ever anſwers beſt, may afterwards be practiſed.

" Theſe two obſervations will be confirmed by ſome experiments which we ſhall give in the fifth article.

" Other buſineſs prevented this lover of agriculture from following his experiments in 1756, with the ſame attention as before. The exact, though ſhort account which we ſhall give of them, may ſerve for a ſequel to what we have been able to collect in relation to thoſe which he made in 1755.

YEAR 1756.

"IN the firſt place, the field of ſix *poſes*, or four acres and a half, which bore a crop in 1754, and another in 1755, and which had not been dunged at all ſince the year 1749, being ſurrounded by a greater piece of land, which is ſowed ſometimes with wheat, and ſometimes with artificial graſſes, was plowed in Auguſt, immediately after harveſt, and ſowed with *ſain-foin.* The crop of 1756 was very fine, each *poſe* yielding from 25 to 30 hundred weight of hay at the firſt mowing, and half as much at the ſecond. *Therefore the new huſbandry preſerved the ground in good condition, without the help of dung*; *and it's productions do not ſeem to have exhauſted the ſoil.*

" The field of about three acres and a half, ſowed with wheat, and which produced 92 meaſures of that grain in 1755, produced but 61 in 1756. The inferiority of this crop muſt be aſcribed, 1. To the error of ſowing wheat that had ſprouted; which, in the opinion of all judges, occaſioned a diminution of at leaſt one fourth: 2. To the damage done by cattle, (this field lying quite open to them,) which was greater this year than it had ever been before; part of the green corn being eaten down twice. This loſs is valued at a tenth part of the crop, independent of the tythe. 3. That the ears were not ſo full of grain this year, in this country, as they had uſed to be: there was as much ſtraw, within ſeven truſſes and a half, as in 1755; but the corn ran leſs into grain, though it ſtill had more than the common wheat.

" Upon the whole, all loſſes and accidents deducted, the crop was worth double what the land would have let for.

“ This field is now under wheat, which looks extremely fine, excepting one *poſe*, which muſt be ſowed again with ſomething elſe, on account of the damage the cattle have done to it. The owner of this field intends to continue ſowing it without dung as long as any heart remains in it; *in order*, ſays he, *to confirm myſelf in what I now think*; *or to find out my error if I am miſtaken.*

“ Another field of betwixt nine and ten *poſes*, (equal to about ſeven acres and three roods,) produced 160 meaſures of wheat; but ſome loads of dung had been laid upon it. However, even the places which had not been dunged produced much ſtronger ſtraw than they did the years before, in which they were ſown by hand. ’Tis true that the dung made the ſtraw ſtronger, but the ears did not yield either more or finer grain. This was likewiſe ſowed with ſprouted corn: but the ſeed was better this year, and accordingly there is a proſpect of a greater crop.

ARTICLE II.

Experiments made on lands ſown in equally diſtant rows with the drill-plough; with ſome reflections on the advantages of this practice.

EXPERIMENT. No. XVII.

“ A LARGE extent of land, near Geneva, continued to be ſown with the drill-plough, in equally diſtant rows. I could inſtance the products of a multitude of experiments, to prove that the fields ſowed in this manner, have always produced much greater crops than thoſe which have been ſown in the common way.

“ I ſhall mention only a few experiments this year: but they are ſuch as have been made on large tracts of ground, and conſequently are more deciſive than ſmall ones, of which we have already given a ſufficient number in the foregoing journals.

" I ſhall call this No. XVII, becauſe it was made by the ſame perſon, and in the ſame places, as that which is marked No. XVII in the year 1754, (p. 234.) I need not repeat what I then ſaid of the ſituation and quality of the land.

" This experiment contains the products of three different farms. About 70 acres were cultivated in the firſt, 34 in the ſecond, and 26 in the third: in all 130 acres, which were ſown with wheat in September and October.

YEAR 1755.

" Quantity of ſeed generally uſed in the old way.	Firſt farm	16002 lb.
	Second farm	7560 lb.
	Third farm	5922 lb.
	Total	29484 lb.
" Quantity of ſeed uſed with the drill-plough.	Firſt farm	7812 lb.
	Second farm	3276 lb.
	Third farm	3150 lb.
	Total	14238 lb.
" Saved in the ſeed		15246 lb.
" Crops of 1755.	Firſt farm	80210 lb.
	Second farm	27690 lb.
	Third farm	27040 lb.
" Total of the crops,		134940 lb.
" To which if we add the ſaving in the ſeed, viz.		15246 lb.
" The whole produce will be		150186 lb.

" I ſhall

"I ſhall now examine what theſe three farms would have produced if they had been cultivated in the old way, ſuppoſing their crops to have been equal to thoſe of 1754; which is much in favour of the old huſbandry.

"I find that theſe three farms, which contain about 130 acres, and which would have required 29484 pounds of ſeed, would have produced at moſt from 75000 to 80000 pounds of wheat; which is 54940 pounds leſs than what was reaped in the new way. The following calculation of the real and effective products in both ways, deducting from each the neceſſary quantity of ſeed, will ſhew the advantage of the new huſbandry in a yet ſtronger light."

NEW HUSBANDRY.

Total produce	134940 lb.
To be deducted for the ſeed	14238 lb.
Neat produce,	120702 lb.

OLD HUSBANDRY.

Total produce,	80000 lb.
To be deducted for the ſeed,	29484 lb.
Neat produce	50516 lb.
Conſequently the balance in favour of the new huſbandry is,	70186 lb.

"This may perhaps ſeem ſurpriſing to many: but my calculation may be the more ſafely depended on, as I have favoured the old huſbandry greatly in my eſtimate of the crops in that way, and have made no deduction for the loſs by ſifting, winnowing, &c. which, even in the very beſt years, is always conſiderably greater in the old huſbandry, than in the new."

YEAR 1756.

" THE ſame farms continued to be ſown with the drill-plough. I ſhall therefore repeat the ſame calculations, to ſhew the conſtant advantage of the new huſbandry, which is ſo much the more remarkable this year, as the corn in the common way yielded but very bad crops. The fields in general produced but few ſheaves and the ſheaves very little grain, and even that was very poor in many places.

" About 90 acres were cultivated in the firſt farm, for the crop of this year; in the ſecond 34, and in the third 45: in all 169 acres, which were ſown with wheat in September and October. About 30 of theſe acres had been dunged."

" Quantity of ſeed generally uſed in the old way,	Firſt farm,	20160 lb.
	Second farm,	7560 lb.
	Third farm,	10080 lb.
	In all	37800 lb.

" Quantity of ſeed uſed with the drill-plough.	Firſt farm	9828 lb.
	Second farm	3654 lb.
	Third farm	5040 lb.
	In all	18522 lb.
" Saved in the ſeed		19278 lb.
		37800 lb.

" Crops of 1746.	Firſt farm	79560 lb.
	Second farm *	19110 lb.
	Third farm	31590 lb.
" Total of the crops		130260 lb.
" To which if we add the ſaving in the ſeed, viz.		19278 lb.
" The whole produce will be		149538 lb.

" * *This farm did not produce ſo much corn as it ſhould have done, becauſe near a third part of the fields was almoſt totally ruined by inundations.*

" Suppoſing this accident not to have happened, what might theſe fields have produced? If they had been ſown in the common way, they would have yielded leſs grain than in the two preceding years. I have eſtimated it at ſomewhat leſs than that, and the advantage is ſtill in favour of the new huſbandry. Theſe three farms would have produced at moſt from 88000 to 93000 pounds of wheat; and, according to this eſtimation, which I think a great allowance, the whole crop would be 37260 pounds leſs than it was.

" To ſee the exact reſult, let us continue our calculations, deducting the grain that was uſed for ſeed."

NEW HUSBANDRY.

" Total produce	130260 lb.
" To be deducted for the ſeed	18522 lb.
" Neat produce	111738 lb.

OLD HUSBANDRY.

" Total produce	93000 lb.
" To be deducted for the ſeed	37800 lb.
" Neat produce	55200 lb.
" Conſequently the balance in favour of the new huſbandry is	75060 lb.

" All theſe calculations prove, year after year, the advantage of uſing the drill-plough. To ſhew how great that advantage is, I ſhall briefly recapitulate what is moſt eſſential in this article.

RECAPITULATION.

" WE have ſeen a very conſiderable experiment repeated three years running, and always attended with great ſucceſs. I ſhall now ſum up the eſſential and deciſive facts, which are ſo many unexceptionable witneſſes, who depoſe, *That it is much more profitable to ſow lands with the drill-plough, than to ſow them in the common way.*

" To this end, I reſume the neat products of the crops.

NEW HUSBANDRY.

Neat Produce of the three FARMS.

		Pounds.
In 1754.	(p. 236,)	93418
1755.	(p. 308,)	120702
1756.	(p. 310,)	111738
Total neat produce of three years		325858

OLD HUSBANDRY.

		Pounds.
In 1754.	(p. 236,)	62200
1755.	(p. 308,)	50516
1756.	(p. 310,)	55200
" Total neat produce of three years -		167916

" The difference in favour of the new huſbandry, in three years amounts to } 157942

"This is an object of great importance, not only to the public, whoſe welfare it highly concerns, but to every owner of land. How ſtrongly does it ſhew the vaſt advantage of the drill husbandry! We here ſee 169 acres of land produce 157942 pounds of wheat more than they would have done without this favourable culture.

"Any one may eaſily reckon the value of ſuch a quantity of wheat, ſuppoſing it to be of the very beſt ſort, as it really was.*

EXPERIMENT, No. XVIII.

"I Shall now give a ſhort account of the ſucceſs of another farm, which I have hitherto ſowed in equally diſtant rows, with the drill-plough. I generally ſow about 23 or 24 acres of it every year. For the crop of 1755, I uſed 1840 pounds of ſeed corn, which produced 10400 pounds of grain. For the crop of 1756, I ſowed 2772 pounds of wheat, the produce of which was 14560 pounds, which is a great deal, conſidering the quality of the land.

"I ſhall conclude this article with a ſhort detail of two little experiments made by the perſon I laſt ſpoke of, on two fields of different ſoils. The firſt, which contained about two acres, was a light ſoil, and ſomewhat ſtony. The quantity of ſeed generally uſed for that ground, was about 380 pounds weight. It was ſowed very thick, with the drill-plough, and took up 252 pounds of ſeed. I attended carefully to the progreſs of this corn. It ripened well, the ſtraw was very long, and crowned with fine ears which yielded 2835 pounds of grain.

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[*] Reckoning the Engliſh buſhel at 62 pounds, theſe 157942 pounds will exceed 320 quarters of wheat.

" The ſecond experiment was made on a ſtiff ſoil. Half the field was ſown in the common way; and the other half in equally diſtant rows with the drill-plough, and only two-thirds of the uſual quantity of ſeed was uſed. This laſt half yielded double what the other did, though it was ſown with a third leſs ſeed.

ARTICLE III.

" THE deſign of this article is, to ſhew that lands which are laid out in beds according to the new huſbandry, produce more corn than thoſe which are only ſown in equally diſtant rows, with the drill-plough. The proof of this propoſition will reſult from proper calculations, and a compariſon of the products of theſe two different methods.

" It is of no ſmall importance to the public, to know exactly which is the beſt and moſt profitable way to cultivate land. This article deſerves ſtill more attention than the laſt, as it tends to point out the means that are in reality moſt advantageous, though oppoſed by an obſtinate attachment to the old huſbandry, and the extreme reluctance with which farmers can ever be induced to try a new practice, which they are almoſt always ready to condemn without taking the pains to know what it is, and indeed, generally, becauſe they are not able to judge of it. It cannot therefore be expected, that the theory alone ſhould ſatisfy them that this huſbandry is conſiſtent with the beſt principles of agriculture. If any thing can convince them, it will be a ſeries of facts, and experiments repeated during a courſe of years, always ſucceſsfully in ſo many different places.

" It is highly eſſential to dwell upon the proofs that the old huſbandry is leſs profitable than the new, in which the field intended to be ſown is firſt laid out in beds: for, after ſhewing that lands ſo laid out and ſown, produce conſiderably more than thoſe which are ſown only in equally diſtant rows with the drill-plough, as has been demonſtrated in the foregoing article; and likewiſe, that theſe laſt produce conſiderably more than they uſed to do in the old husbandry; the ſuperiority of the crops which the beds afford, will certainly appear ſtill more ſtriking, and no doubt will remain of the excellence of the new culture.

"To this end, we ſhall compare the neat produce of the three farms mentioned in the foregoing article, in this year 1756, with that of the fields which I have laid out in beds.

"In conſequence of the general opinion that dung, or any kind of manure, contributes greatly to fertilize land, and makes it produce more than it would otherwiſe do, it is to be obſerved in the firſt place, that part of the land of the three farms was dunged, and that my fields, cultivated in beds, had not had any dung or other manure for many years.

"Secondly, that the lands of the three farms are always fallowed every ſecond year; whereas my fields have been ſown every year ſince they firſt began to be cultivated in the new way, and have already borne ſeveral crops running.

"Thirdly, it ſhould be conſidered, that the year 1756 was extremely rainy: a circumſtance by no means favourable to ſtrong ſtiff ſoils, like mine; and at the ſame time rather beneficial than hurtful to the three farms, a great part of which is light land, which requires frequent rain.

"Laſtly, the reader will remember, that about a third part of the ſecond farm was overflowed, whereby the crop was diminiſhed: but on the other hand, I think this damage is pretty nearly compenſated by the accidents which happened to my field, (experiment No. IV. (p. 284,) which certainly leſſened the crop conſiderably.

"Theſe reflections ſeemed to me neceſſary, in order to give a juſt idea of the compariſon I am going to make, which, I believe, will be ſufficient to prove what I purpoſed to ſhew."

Compariſon of the produce of land ſown in equally diſtant rows with the drill-plough, with that of other land laid out in beds.

"The neat produce of the three farms, containing about 169 acres, which were ſown in equally diſtant rows with the drill-plough, was, after deducting the ſeed,

		Pounds.
Of the	Firſt Farm	69732
	Second Farm	15456
	Third Farm	26550
Total neat produce		111738

"Neat produce, after deducting the ſeed, of the fields laid out in beds, and ſown with the drill-plough; with the number of each experiment, and the meaſure of each field.

			Pounds.
Experiment, No: 2.	p. 259.	1½ acre	1834
4.	284.	15	2824
5.	285.	7¼	2156
6.	286.	2½	627
7.	289.	15	5750
8.	290.	1	1850
9.	293.	6	1924
10.	294.	6	2352
	In all	54 acres	
Total neat produce in 1756		- - -	19317

" After the beds are once formed, the ſame fields are ſown every year: conſequently theſe will produce another crop in 1757, which, ſuppoſing it to be only equal to the laſt, though there is great reaſon to think it will be much better, will again be } 19317

" Fifty four acres will then produce neat, in two years, } 38634

" The 169 acres of the three farms ſown in equally diſtant rows with the drill-plough, will not produce any thing in 1757, that being their year of fallow; conſequently their neat produce in two years, will have been only 111738 pounds of wheat, whilſt the 54 acres made into beds, will have produced 38634 pounds. But ſuppoſing the 169 acres to have been cultivated in beds, and their produce to have been in the ſame proportion as that of the 54 acres, it would amount to 134769 pounds, which is 23031 pounds more than they produced when ſown in equally diſtant rows with the drill. This difference ought never to be forgot.

"The new method of laying the land out in beds, has ſtill greater advantages than this. Our compariſon has been only of the neat produce of 169 acres which were ſown the ſame year in the three farms: but it is to be obſerved, that theſe farms conſiſted of 169 acres more, which were under fallow for the next year's crop. The neat produce of the crops of thoſe 338 acres in the two years of ſowing them in equally diſtant rows with the drill-plough, ſuppoſing both crops to be equal, would be

	Pounds.
For the firſt year, 169 acres	111738
For the 2d year, for the other 169 acres	111738
For the two years - -	223476

"If theſe 338 acres were laid out in beds, they would be ſown each year, and their neat produce, ſuppoſing both years alike, would be,

	Pounds.
For the firſt year, 338 acres	134769
For the ſecond year, 338 acres	134769
For two years - - -	269538

"So that this calculation proves plainly, that the 338 acres will produce 46062 pounds of wheat more when cultivated in beds, than when ſown in equally diſtant rows with the drill-plough: a difference which, in ten years, will amount to 230310 pounds of grain.

"As great as this advantage is in favour of the beds, it will appear very ſmall when compared to that which the culture in beds has over the old huſbandry: as the following calculation will ſhew.

" Let us firſt ſettle what would have been the neat produce (by which we always mean that which remains after deducting the ſeed) of the 169 acres of the three farms, for one year; and afterwards that of the other 169 acres the next year, ſuppoſing both crops to be equal.

" We have already ſeen that the produce of 169 acres would, at moſt, not have exceeded 55200 pounds of wheat, in 1756. But as that was a bad year, I will make the following compariſon on the footing of a good crop, in order to give the old huſbandry every advantage that can poſſibly be deſired. I will therefore ſuppoſe the neat produce of 169 acres to have been the firſt year 76000 lb.

and that of the other 169 acres, the next year, - - - -	76000 lb.
For the two years	152000 lb.

" We have ſeen that the ſame 338 acres cultivated in beds, reckoning their neat produce for two years only on the footing of the bad crop of 1756, would have yielded 269538 pounds of wheat: conſequently this culture would have produced in two years 117538 pounds of corn more than the old huſbandry; and this difference, in ten years, would amount to 587690 pounds.

" The great advantage of the new huſbandry, in general, and that of laying the ground into beds, in particular, is, I think, now fully proved. The difference is great indeed! But I believe it will be ſtill much greater hereafter, when the yearly obſervations of the followers of this new way, whoſe number increaſes daily, ſhall have brought this culture to a greater degree of perfection; which I hope will, in ſome meaſure, be the caſe next harveſt."

Reſult

Reſult and Compariſon of divers Experiments in Agriculture made at Fontclaire, *near Avignon, by* M. d'Elbene, *in the years* 1757, 1758, *and* 1759. *Communicated to* M. Duhamel.[a]

EXPERIMENTS.

made in 1757.

"THE principles of the new huſbandry ſeemed to me ſo well eſtabliſhed, that I reſolved to practice it. To this end, I took into my own hands the farm I am now going to ſpeak of, in 1756; and, not to burden myſelf with ſo conſiderable a detail as muſt of courſe ariſe from the number of labourers neceſſary to cultivate ſuch an extent of ground, I divided the greateſt part of it into lots, which I aſſigned to peaſants who undertook to perform by hand moſt of the work that was to be done, and to be at all the expence of harveſting, to the laying up of the corn threſhed and winnowed, in conſideration of one half of the produce.

"The ſhare of each of theſe peaſants was about three acres, of which one half was to lie fallow every year. They took great care to portion out the land in ſuch manner that the good and bad were equally divided among them.

"Some fields of an excellent quality were not included in this diſtribution: but the farmers to whom I entruſted them promiſed me two hundred pounds of wheat for every acre, over and above the half of the product.

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[a] *Culture des Terres, Tom.* VI. C. I. *art.* 17.

" I deſtined two fields, one of which was pretty good, and the other very bad, to be laid out in beds.

" M. de Chateauvieux was ſo kind as to ſend me the ploughs, drill, and cultivator, which he has invented: but I did not receive them in time for this year's preparation of the ground, which had but two plowings.

" I began to ſow a ſmall part of my fields, according to the new method, on the 19th of Auguſt. The reſt was ſown before the 25th of September, and the peaſants ſowed theirs in the beginning of October.

" The autumn was rainy, and favourable to the riſing of the corn, which made a great progreſs before the beginning of winter: but this ſeaſon proved ſo very wet and cold, that my plants ſuffered greatly in thoſe lands where they are apt to be forced out of the ground by froſt: many of them were abſolutely torn up in ſeveral fields ſown according to the old way, or in equally diſtant rows with the drill-plough; and ſeven or eight acres were ſtripped entirely of all their growth.

" The beds, being arched, eſcaped unhurt, becauſe the wet did not ſettle upon them. Favourable weather in the ſpring, accompanied with gentle rains, repaired the miſchief which the winter had done, wherever any plants remained.

" The wheat in the new way began to ear on the 20th of April; and that in the old way, on the 5th of May. The grain was full grown by the end of this month. Frequent rains and dews which fell in June kept the earth cool, without too much haſtening the corn, which was reaped between the 21ſt of June and the ſecond of July. The ſheaves were very long, very heavy, and yielded plentifully in all my land: I found pretty commonly, in my beds, ears which had from 80 to 90 fine plump grains: but in my other ground, the largeſt did not contain above 25, and part of them was ſhrivelled.

" The crops were but indifferent in this country, in general. They were very bad in ſeveral places; and thoſe of my neighbours who had the beſt, looked upon this as a middling year. As I had found it a very good one in this farm, I was deſirous to aſcertain the degree of advantage ariſing from good culture; for I could not impute the ſuperiority of my crops to any other cauſe. To this end I computed what theſe ſame lands had produced when cultivated in the ſame way as all others ſtill are in theſe parts. I could eaſily do this, as my father, grandfather, and great-grandfather had kept very exact accounts of all their crops, and the original papers relating thereto are now in the hands of my father at Avignon. I there found the whole detail, year by year, ever ſince 1677, and carefully made from thence the following calculation.

" *Reſult of the produce of the lands of this Farm from the year* 1677 *to* 1756 *incluſively.*

The quantity of land ſown in this ſpace of time was	4660 acres,
With - - -	875887 l.
Which yielded - - -	2,914987 l.
The neat produce, after deducting the ſeed, was	2039099 l.
But as only one half of the land of this farm was ſowed every year, whilſt the other half lay fallow; it is evident that this quantity of corn was produced by double the land abovementioned; that is to ſay, by	9320 acres.
Which produced - -	2039099 l.

The farmer had half of this product, for the expence of culture. Conſequently the landlord had but	1019549 l.
From whence it follows that the landlord received for each acre of land	109 l. 6oz.

“ *Produce, from* 1677 *to* 1756.

“ To eſtimate this produce in money, I ſuppoſe the price of the fineſt wheat to have been conſtantly at eight ſhillings and nine pence for an hundred pounds weight, which is the medium value in theſe provinces. The corn of which I now ſpeak was not worth ſo much; a conſiderable quantity of oats and rye being included in the above product, and likewiſe the ſiftings, which are, taking one year with another, from 15 to 20 *per cent.* An exact calculation of the neat produce of ſome years proved that this diminution was from 35 to 40 *per cent*: but to avoid all error, I deducted only thirty *per cent.* from the fixed price of the fineſt wheat. This gave me ſix ſhillings and three halfpence for an hundred pounds of my corn, and ſix ſhillings and eight pence for the 109 pounds abovementioned, which was the medium annual produce of each acre of land during the ſpace of eighty years.

“ By thus calculating the crops every year, I was enabled to know the advantage of each different kind of culture. The greateſt part of my farm was ſowed in the old way in 1756; a ſmall portion of it was ſowed in equally diſtant rows with the drill-plough, and only two pieces of ground were managed according to the principles of the new huſbandry.

“ *Produce, in 1757, of the land ſown in the old way.*

I ſowed	58 acres,
With	9722 l.
They produced	55849 l.
Deducting the ſeed, there remained	46127 l.
Abating half of this for the year of fallow in which theſe lands do not produce any thing	23063 l. 8 oz.
And likewiſe the huſbandman's half; I had, as landlord	11531 l. 12 oz.
So that each acre of land yielded me	198 l. 13 oz.
Or, at ſix ſhillings and three halfpence the quintal, for the reaſons before mentioned	12 s. 2d.

“ *Produce, in 1757, of land ſown in equally diſtant rows with the Drill-plough.*

I ſowed	2 acres and ½
With	198 l. 12 oz.
Which produced	2400 l.
Deducting the ſeed, there remained,	2201 l. 4 oz.
Of which abating half for the year of fallow	1100 l. 10 oz.
And deducting alſo the labourer's half	550 l. 5 oz.
I had, for the produce of each acre	220 l. 2 oz.
Worth, at 6s. and 3 halfpence the quintal,	13 s. 6d.

“ *Produce, in 1757, of the land ſown according to the principles of the new Huſbandry.*

I ſowed	5 acres and ¾
With	110 l. 10 oz.
Which yielded	4837 l. 8 oz.
Deducting the ſeed, there remained	4726 l. 14 oz.
And abating only half of this, for the huſbandman's ſhare, becauſe this land is never fallowed; I had, as proprietor	2363 l. 7 oz.
So that my product from each acre was	411 l. 1 oz.
Which, at 7s. and 10d ½. the quintal, at which I rate it for the following reaſons, makes	32 s. 4d. ½

"I did not think it right to deduct here the thirty *per cent.* from the medium price of the fineſt wheat, becauſe all this laſt was perfect grain, quite clean, and entirely free from any mixture of ſeeds of weeds; whereas I had not only reaped rye, oats, and barley, among that which was raiſed in the old way; but the ſiftings there were very conſiderable, and the corn, even after that, was not near ſo fine as the growth of the new huſbandry. I deducted however ten *per cent.* from the price of the very beſt wheat, that I might not be any way partial to this method, though I ſold it's produce at the higheſt price.

"The advantage of the new huſbandry was infinitely greater than I expected. I am ſure that my reckoning is right; for my lands were diſtributed in ſuch manner that I could not miſtake. Each peaſant laid his ſheaves in a ſeparate heap, threſhed them, winnowed their grain, and divided the product with me. My ſheaves were alſo piled up, threſhed, and winnowed a-part, and their product was meaſured before all my ſervants and a number of peaſants, who were aſtoniſhed at it.

"It is true that I mixed the ſheaves reaped from the ground ſowed in equally diſtant rows with the drill-plough, with thoſe of the beds: but I reckoned before hand the quantity of each, as I could eaſily do by means of the tythe, which is every twelfth ſheaf, and made my calculations according to the number of the ſheaves, though thoſe of the beds certainly contained the moſt grain.

"Some of my neighbours, determined by the great ſuperiority, which they had obſerved from the very firſt, of my corn in the beds, beyond all the reſt, reſolved to practiſe the new huſbandry; but moſt of them were deterred by a notion of it's being too expenſive. This objection deſerved ſerious attention. I therefore, to know how far it was really founded, calculated the expence of each kind of culture in a manner leſs ſubject to error than any former way of reckoning. I ſuppoſed all the work to be done by day-labourers; and I had thereby a ſure means of compariſon, by ſuppoſing, as I could eaſily do with certainty, the quantity of work which a plough or a man did in a day, and how much each of them earned.

"I made this calculation in 1758, and ſent a copy of it to M. de Chateauvieux: but as I had forgot to notice there the charges of weeding and reaping, which are articles of conſiderable expence, I have inſerted that omiſſion in the following more careful computation.

"*Expence of the firſt year's culture of an acre of land, when it is firſt laid out in beds.*

"To give an acre of ground that perfect tilth which M. de Chateauvieux deſcribes (in the 214th and following pages of this volume), will coſt, in this country, including the expence of weeding, performed by hand with hoes four inches wide (which will ſtir the ground pretty well), and all the charges of harveſt, to the laying up of the corn winnowed and cleanſed	£. 2	3s.	3d.
"The culture which I intend to practice, and which conſiſts in only the four firſt plowings of the above article, with the ſame expences of weeding and harveſting, coſts - - - - -	1	12	8
"The culture which I gave to my land in 1756, conſiſting in one plowing in broad-lands, and a ſecond to arch up the beds, with the expence of weeding and harveſting, as above, coſt me -	1	3	4
"Two plowings in broad-lands in 1757, with the ſame expences as before in other reſpects, coſt me - -	1	8	7½

" *Annual expence of cultivating an acre of land after the beds are formed.*

" To bring an acre of land to perfect tilth, by giving it five plowings, three of which are performed with the plough and two with the cultivator in the alleys, and a ſixth thorough plowing of the whole ground immediately after harveſt, will coſt, with the ſame expences of ſowing, weeding and harveſting, as before mentioned - - £. 1 2 *s.* 7 *d.*

" I have not yet given this general plowing to the whole of any of my fields; but have hitherto reſtricted the ſixth plowing to the alleys only. This, with the ſame expences as before for all the reſt, has coſt me - - - 1 0 0

" *Expence of cultivating an acre of land according to the old method.*

" It is proper to obſerve, that, in all the following calculations, I have charged the huſbandman with only half the real coſt of each kind of culture for each year, becauſe the lands, being reſted alternately, are cultivated only every other year. I give a peaſant four acres of land to cultivate, and he plows two of them every year. The culture of theſe two acres coſts him (at £. 2 12 *s.* 0 *d*, each) £. 5. 4 *s.* 0 *d.*; which is after the rate of £. 1 6 *s.* 0 *d.* a year for each of his four acres.

" The perfect culture of our peaſants, who give the ground five ſtirrings by hand, the firſt with a kind of ſpade (with which they dig twelve or fourteen inches deep), and the four others, including that which ſerves to bury the ſeed, with a ſort of hoe or mattock (which ſtirs the earth eight or ten inches deep), coſts, with the uſual expences of weeding, getting in the harveſt, and cleanſing the corn - - £. 1 6 *s.* 3 *d.*

"The culture of the peaſants, which is now practiſed throughout the whole of my eſtate, conſiſts in four ſtirrings of the earth, the firſt of which is performed with their ſpade, with which they are ſo idle as not to dig deeper than ſeven or eight inches: the ſecond is given with a kind of hoe, which does not penetrate above five or ſix inches deep; the third with the common plough of this country, without wheels or mould-board, which, even when drawn by the ſtrongeſt mules, can never enter deeper than five or ſix inches; and the fourth, which ſerves to bury the ſeed, either with that plough, or their hoe, which ever they like beſt. Their expences of weeding, reaping, &c. are the ſame as in the foregoing article, and it coſts them, in all, for each acre of land - £. 0 18s. 4d.

"Within theſe few years paſt, ſome more careful huſbandmen give the firſt ſtirring with a plough with one wheel and a mould-board, drawn by ſix ſtout mules. This cuts ſeven or eight inches deep; and they perform the five other ſtirrings with their common plough. Their expences of weeding and harveſting are the ſame as thoſe of the peaſants, and each acre coſts them 0 15. 7

"Some give but two plowings, inſtead of five, with the common plough of this country. Their expences are the ſame in other reſpects, and the acre coſts them - - - - 0 11. 6

"The generality of our huſbandmen do not yet uſe wheel-ploughs. The moſt diligent among them give ſix plowings with the common plough of this country. Their expences for weeding and getting in the harveſt are the ſame as above, and the acre ſtands them in - - - - - - 0 13. 5

"The ſlothful, who, unhappily, are the greateſt number, give their land only three plowings with our common plough: but as they cannot avoid the expence of reaping and houſing their corn, each acre coſts them - - 9. 2

“ The charge of tillage is not near ſo great to thoſe who aſſiſt perſonally in the work, or even to theſe who keep their own labourers and cattle. A minute examination of this point induces me to think, that it does not coſt the former above half, nor the latter above two thirds, of the ſums mentioned in the foregoing accounts.

“ From hence it follows, that every huſbandman will be repaid his diſburſements whenever his ſhare of the product, which is always equal to that of the landlord, is, for him who labours perſonally, one half, and for him who does every thing by his ſervants, two thirds of the above ſums, and that he will find a very conſiderable advantage in practiſing any method of which the product will repay his advancing money to day-labourers to do the work.

“ A proof of this is, that the peaſants who tilled my lands were very well ſatisfied with their gain, though their expences amounted to 18 *s.* 4*d*, and, like me, they cleared but 13 *s.* 6 *d.* by each acre of ground.

“ Where the land was ſowed in equally diſtant rows with the drill-plough, the expences were the ſame as in our common way; but the profit was greater.

“ Though the expences of the new huſbandry, where the land was laid out in beds, amounted to 1 *l.* 3 *s.* 4 *d.* an acre; yet it was more advantageous to the huſbandman, who cleared, as I did in quality of landlord, 1 *l.* 12 *s.* 6*d.*

“ We ſee, however, by theſe calculations, and the fact really is, that ſuch expence attends the laying of land out in beds, as may very often not be repaid the firſt year: but when the new huſbandry is once eſtabliſhed, thoſe expences leſſen, and it appears that the cultivator will find his account

count in practiſing it, as much as the owner of the land.

" *Experiments made in* 1758.

" My ſucceſs determined me to increaſe the number of my beds. I prepared, more carefully than the year before, a large piece of land, the ſoil of which was bad, and of which my farmers uſed always to ſow a part with rye or oats. Several peaſants adopted the method of ſowing in equally diſtant rows with the drill-plough. I ſowed my lands in the new husbandry in the month of September, and my other fields in October. The earth was ſtill gravelly, in poor tilth, and wanted moiſture. No rain fell during the months of September, October, and November. The corn roſe but indifferently even in the beſt prepared ſoils, and ſcarce a fourth part of it roſe in the common fields. It made very little progreſs before winter, and was not forwarder in the middle of January than it commonly is a fortnight after being ſown. We had, however, in December and in the beginning of January, ſome ſlight rains, which, though they did not penetrate far into the earth, were ſufficient to make ſome of the corn that had not yet appeared, ſprout, and even to give the country a greeniſh hue. Froſts, which laſted from the 18th of January to the 4th of February, with ſuch ſeverity as is ſeldom known in this country, ſoon baniſhed this gleam of hope. They were accompanied with an impetuous north wind which added greatly to the violence of the cold. I viſited my corn as ſoon as the weather began to grow a little mild, and found it's blades abſolutely withered; though I ſtill diſcovered, with difficulty, a yet green part in the heart of ſome of the plants: but half of them were ſo totally deſtroyed, as not to retain the leaſt ſign of verdure. In ſome places, which were ſheltered from the wind, the blades were not at all withered; which made me think that the miſchief done to the reſt might proceed from ſome pernicious quality in the ſharp wind, rather than from the froſt.

"Though the plants were dead, they ſtuck faſt in the ground, and none of mine were either rooted up, or laid bare by the froſt. The great drought preſerved them from this accident, which would have totally ruined all the corn.

"The thaw was without rain, of which we had not any till the 14th of April, when it might have been of ſervice to the plants, but that ſnow (a phenomenon almoſt unknown here, even in the winter,) fell on the 17th, and was followed by a hard froſt which laſted two days, and not only prevented the good effect which we expected from the rain, but likewiſe did conſiderable hurt to all the productions of the earth, which, though they did not immediately appear to have been injured thereby, grew but poorly afterwards.

"My corn in the new huſbandry, where the intervals between the beds had been hoed at the end of February, throve well, and began to look promiſing: but within a few days after the froſt, I perceived marks of it's being *rickety*, and this diſtemper ſoon made a rapid progreſs.

"The wheat in the common way, even in the beſt ſoils, was very thin, had not tillered, and was ſtill in nearly the ſame condition as at the end of the winter.

"The rain which fell on the 23d of April did not do any good; nor had we any more of it from that time till the 27th of May. The corn was then in a deplorable condition: the ears of that in the new huſbandry were beginning to appear; the winter had not left a third part of the plants, and moſt of thoſe that did remain were ſtinted and quite rickety.

" The lands in the old way promiſed ſtill leſs. The plants there, beſides continuing to be very thin, were crooked and rickety, and ſeemed ſcarcely able to put forth their ears.

" Thirteen acres of extraordinary good land, the culture of which was not begun till after the froſt on the 19th of April, were the only ſpot that afforded ſome little hope. Till that froſt, the wheat in the beds was greatly ſuperior to any in this ground. Could the cauſe of this alteration proceed from the froſt's acting more powerfully upon, and conſequently doing greater injury to, the plants which were in full ſap, and whoſe ſhoots were yet tender, than on thoſe where the ſap was not yet in motion, and which had not yet begun to ſpindle? I thought ſo, and to me it ſeemed probable.

" Buſineſs obliged me to be abſent during the firſt fort'night in June, and I was greatly ſurpriſed at my return to find the corn, which had ſcarcely begun to ear when I left it, almoſt ready to ripen. Cold dews followed by great heats, and perfectly ſcorching weather which we had from the 6th to the 12th of June, joined to the dryneſs of the earth, occaſioned this ſudden change.

" A violent north eaſt wind, which blew impetuouſly from the 18th to the 21ſt of June, completed our misfortunes, by ſhedding great part of the corn which bid faireſt to ſucceed. The loſs occaſioned by this accident was valued at one third of the crop: nor could it well be leſs; for, after ſome ſhowers which fell in July, the whole field was covered with young plants, as thick as if they had been ſown upon the ſtubble.

" The crop was reaped between the 21ſt and 29th of June. It could not be a good one after ſuch adverſe events; nor was I, conſequently, ſurpriſed at finding the reſult of it different from that of the preceding year.

“ *Product in* 1758, *of the lands ſowed in the old way.*

“ I have kept a ſeparate account of one part of theſe lands, conſiſting in meadow ground newly broken up, and a field that was dunged all over in 1756, which never happened to any other, either wholly or in part. The peaſants charged with the culture of this part engaged to give me two hundred pounds of grain over and above the half of the product.

“ *Produce, in* 1758, *of the very good lands ſown in the old way.*

I ſowed - - - -	13 acres.
With - - - -	2424 l. 6 oz.
Which produced - - -	10005 l.
Deducting the ſeed, there remained -	7580 l. 10 oz.
Abating half of this for the year of fallow,	3790 l. 5 oz.
And alſo half of this remainder for the labourer's ſhare; I had, as owner of the land, - -	1895 l. 2 oz. ½
So that each acre yielded me -	145 l. 12 oz. ½
Worth, in money, at ſix ſhilllings and three halfpence the quintal, for the reaſons mentioned in p. 322, -	8 s. 11 d. ¾

“ The labourer, being obliged by our agreement to give me part of his half, had, in reality, but 46 l. which may be valued at 2 s. 9 d.

“ *Produce, in* 1758, *of the ordinary lands ſown in the old way.*

I ſowed - - - -	25 acres.
With - - - - -	4316 l. 4 oz.
Which produced - -	8760 l.
Deducting the ſeed, there remained	4443 l. 12 oz.

Allowing

Allowing half of this for the year of fallow	2221 l. 14 oz.
And half of the remainder for the labourer's ſhare, I had, as landlord,	1110 l. 15 oz.
Which makes, for each acre -	44 l. 4 oz. $\frac{1}{2}$
Worth, in money, at ſix ſhillings and three halfpence the quintal,	2 s. 8 d. $\frac{1}{2}$

“ I afterwards united theſe two calculations, in order to have the total product of my lands ſown in the old way, and found it to be as follows.

“ *Produce, in* 1758, *of all the land ſown in the old way.*

I ſowed - - -	38 acres.
With - - -	6740 l. 10 oz.
Which produced - - -	18765 l.
Deducting the ſeed, there remained -	12024 l. 6 oz.
Allowing half for the year of fallow	6012 l. 3 oz.
And half of this for the labourer's ſhare, I had, as landlord	3006 l. 1 oz. $\frac{1}{2}$
Being, for each acre - - -	79 l. 2 oz.
Which, in money, at ſix ſhillings and three halfpence the quintal, for the reaſons aſſigned in p. 322, is equal to	4 s. 8 d. $\frac{1}{4}$

“ *Produce, in* 1758, *of the lands ſown in equally diſtant rows with the drill-plough.*

I ſowed - - -	9 acres.
With - - -	916 l. 14 oz.
Which produced - - -	3406 l. 14 oz.
Deducting the ſeed, there remained -	2490 l.
Allowing one half of this for the year of fallow	1245 l.
And deducting again the labourer's half there remained	622 l. 8 oz.
I received, as landlord, for each acre, in corn	69 l. 2 oz.
And in money, at ſix ſhillings and three halfpence the quintal	4 s. 3 d.

Note, I have included here the product of two thrids of an acre of meadow land newly broken up, which yielded ſeven times the ſeed.

"*Produce, in 1758, of the lands ſown according to the new husbandry.*

I ſowed	18 acres and ½
With	703 l. 4 oz.
Which produced	2250 l.
There remained, after deducting the ſeed,	1546 l. 12 oz.
And allowing half of this for the labourer, as the lands in this huſbandry are never fallowed, there remained for the landlord	773 l. 6 oz.
Being, for each acre, in corn,	41 l. 11 oz. ½
And in money, at 7 s. 10 d. ½ the quintal, for the reaſons aſſigned in p. 324.	3 s. 3 d. ¼

" Our very unfavourable ſeaſons could not but affect the crops; nor was it poſſible that any kind of culture ſhould guard againſt the repeated accidents which befel my corn. The misfortune extended to all the neighbouring provinces, and wheat, which had not been at above nine ſhillings and two pence farthing the quintal, for ſeveral years paſt, roſe to thirteen ſhillings and three halfpence, and kept at this price during the whole year, notwithſtanding that there was a great deal of old corn in all the granaries, and quantities arrived from other countries.

" This unſeaſonable weather was not only fatal to the corn, but likewiſe to all vegetation. Though the leaves of our mulberry trees did not ſeem to have been much hurt by the froſts in April, they were however ſo damaged as to become pernicious to the ſilk-worms, which did not ſucceed any where. The winter killed all the clover in our fields, we had very little early crops of hay, not any ſpring-corn, and ſcarcely half the uſual quantity of wine and oil: even our ſaffron, which is a conſiderable article in this country, produced very few flowers: in ſhort, the oldeſt man could hardly remember ſo bad a year. The new huſbandry did not fare better than the old: it could not reſiſt the rigour of the cold, which deſtroyed very many of the plants and all the blades of the corn. The froſts in April were ſtill more fatal by the rickety diſtemper which they occaſioned; and the high winds in June did greater hurt to the wheat in the beds, where the grain was leaſt ſhrivelled, than to that in the old way. It appeared from an eſtimate of a number of ears taken as they came, without culling them, that half the product of the beds was loſt through this laſt accident.

"Notwithſtanding all theſe misfortunes, when it is conſidered that two thirds of my fields in the new huſbandry were my worſt lands, and that the whole of them cannot be compared with thoſe of the farm in general, and much leſs with lands of the very beſt quality, it will be found that this method afforded a profit, though not ſuch as to induce one to prefer it to all others.

"I had already prepared another field of about four acres, in order to lay this likewiſe out in beds, as in fact I did: but I reſolved to wait the event of the year 1759, of which I am now to ſpeak, before I proceeded farther in this method.

Experiments made in 1759.

"Rain, which we wanted before harveſt, came after it, in ſuch abundance that all work in the field was ſuſpended during the whole ſummer.

"Twelve acres of my land in beds ſuffered greatly by an inundation of the Oveze, a neighbouring river, which over-flowed it's banks on the 6th of July. The water drowned entirely all this ground, and waſhed away the ſummit of the beds in ſeveral places. The plough could not begin to work till September; and though the culture which I then gave formed new ridges, yet it could not pulveriſe the earth, or arch up the parts intended to be ſown, which, in many places, were ſettled lower than the ſtubble.

" I ſowed all my lands in the new husbandry within the firſt fortnight in September, and thoſe in the old way before the middle of October. The autumn was very rainy, and conſequently favourable to the ſprouting of the corn, which was however ſomewhat too thin in the part that had been overflowed. The plants in the beds were very fine in the beginning of December (at which time I was obliged to loſe ſight of them), excepting the field of about four acres, which was now ſown for the firſt time in this way, but with two turns of the drill plough, and in which the corn began to be ruſted. I did not return to this farm till the middle of April.

" The winter had been very mild and wet. I found the corn in the beds very fine, and ſuperior to all the reſt, but too thin in the places which had been damaged by the flood. The field which began to be ruſted in autumn, was now more ſo, and promiſed little; but, through the negligence of my ſervants, the alleys wanted ſtirring, and weeds choaked the corn in ſeveral places. I endeavoured to remedy this by good hoeings and careful weeding, which could not be performed in this advanced ſeaſon, without pulling up many of the plants of corn. Notwithſtanding all my endeavours to correct the evil, I am perſuaded that this neglect coſt me a part of the crop I might otherwiſe have had.

" We had a good deal of rain on the firſt and ſecond of May; but a ſharp north-eaſt wind which blew violently during the reſt of that month, hurt the corn greatly when it firſt began to ſpindle, and dried the earth at a time when we never find it too moiſt.

“ Gentle rains and plentiful dews, which fell in the beginning of June, ſucceeded this ſtormy weather, and ſeemed to remedy the miſchief which the high winds had done.

“ The wheat was cut between the 16th and 27th of June. It's ſtraw was ſhort, though long enough to bind up in ſheaves, which looked well. The grain was plump, and of a very good quality. The only complaint was of it's being mixed with a great quantity of darnel.

“ We had hopes of a plentiful harveſt. The price of wheat fell at once, towards the end of June, from thirteen ſhillings to ſeven ſhillings and ten-pence the quintal; but by the middle of July it roſe to twelve ſhillings and three-pence, and ſtill keeps at that price in the preſent month of January 1760, notwithſtanding the immenſe quantities which arrive here daily from other countries.

“ Our flattering hopes ſoon vaniſhed. The ſheaves yielded but very little grain, and the harveſt proved extremely bad, contrary to the expectation of every one. I endeavoured to trace the cauſe of this miſtaken opinion, and found it to be, that our huſbandmen had judged by the length of the ears, without conſidering that a great many of the huſks were ſo empty as not to have the appearance of corn in them. This accident ſeemed to me to have been occaſioned by the plants having loſt their bloſſoms, through the impetuoſity of the winds, which never ceaſed to blow with great violence during the whole time that the wheat was in bloom, and whilſt the grains ſhould have kerned.

“ The corn in the new huſbandry was equally affected by theſe adverſe events; but it's ears were better filled with grain, than thoſe of the wheat raiſed in the old way.

“ The people in theſe parts look upon this year as having given but half a crop: mine was tolerably good.

“ *Produce, in* 1759, *of the lands ſown in the old way.*

I ſowed	23 acres.
With . . .	3731 l. 4 oz.
Which produced . . .	17202 l. 8 oz.
Remained, after deducting the ſeed .	13471 l. 4 oz.
Allowing half of this for the year of fallow	6735 l. 10 oz.
And half of the remainder for the labourer	3367 l. 13 oz.
I had, for each acre of land, .	146 l. 7 oz.
And in money, at ſix ſhillings and threepence the quintal	9 s.

“ *Produce, in* 1759, *of the lands ſown in equally diſtant rows with the drill-plough.*

I ſowed	20 acres. ½
With	2353 l. 2 oz.
Which produced : .	19221 l. 14 oz.
Deducting the ſeed, there remained .	16968 l. 12 oz.
Allowing half of this for the year of fallow,	8484 l. 6 oz.
And half of the remainder for the labourer's ſhare,	4242 l. 3 oz.
I had, for each acre, . : .	206 l. 15 oz.
And in money, at ſix ſhillings and three half-pence the quintal	12 s. 3 d. ½

“ *Product, in* 1759, *of the lands ſown according to the principles of the new Husbandry.*

I ſowed	24 acres.
With	1261 l. 14 oz.
Which produced . . .	12150 l.
Deducting the ſeed, there remained	10888 l. 2 oz.
And only half of this for the labourer's ſhare, as theſe lands are not ever reſted, I had	5444 l. 1 oz.
Which is for each acre of land .	227 l. 7 oz.
And in money, at 7s. 10d. ½ the quintal	17 s. 9 d.

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"I may, perhaps, be thought to favour the new husbandry in my eſtimate of it's produce, in money: but I can aver that, this year, my land in beds, though part of it was deemed fit for rye only, produced nothing but very fine wheat, which ſold at market for twelve ſhillings and three-pence the quintal. My lands ſown in the old way, or in equally diſtant rows with the drill-plough, produced 4200l. of oats, 900l. of barley, and 800l. of rye. The ſiftings of my wheat raiſed in the old husbandry amounted to a twelfth part of the crop; ſo great was the quantity of darnel mixed with it: a quarter part of the remainder ſold only at the price of rye, and the very fineſt part of it fetched no more than 10s. 6d. the quintal, at the very market where the wheat of my beds ſold for twelve ſhillings and three-pence, without having been ſifted.

"I have, however, deducted ten *per cent.* from the wheat of the new husbandry, though it ſold at the higheſt price, and have abated only 30 *per cent.* on that of my other lands, though an exact calculation proved to me that the loſs upon it amounted really to thirty-three *per cent.*

"The dearneſs of corn this year increaſed the price of all the productions of the earth to above one third more than before: a circumſtance which added conſiderably to the value of every advantage in husbandry, as the expences attending this were ſtill the ſame.

"The reſult of theſe three years affords a manifeſt evidence of the benefits which accrue from good tillage, and ſeems to prove plainly the ſuperiority of the drill plough over the common method of ſowing, and that of the new husbandry over the old.

"The harveſt in 1757 was but middling throughout this country, and good in my farm only. It was bad in 1758, becauſe nothing could poſſibly guard againſt ſuch adverſe weather as we then had. In 1759, no one in theſe parts had ſo good crops as mine were. Theſe ſucceſſes cannot be aſcribed to any other cauſe than the manner in which my lands have been cultivated.

" The diſtribution of my lands proves likewiſe evidently the advantage of ſowing in equally diſtant rows with the drill-plough. My peaſants ſpared no pains to render their reſpective portions equally fruitful. They cultivated them in the ſame manner, excepting only in the ſowing of the ſeed, where the drill plough, ſowing in equally diſtant rows, alway yielded a greater profit than the common way.

" The lands ſown in beds yielded ſtill more grain than thoſe ſown either in the old way, or in equally diſtant rows with the drill, in 1757 and 1759. This advantage cannot have been owing to any other cauſe, as I did not uſe dung any where; the culture there was not performed more carefully than in my other grounds; it coſt very little more than that of the peaſants; and a part of the fields in beds is known to be ſome of my worſt land, for which reaſon my farmers had always uſed it for rye.

" The year 1758 was ſo fatal to all the productions of the earth, that we ought rather to wonder at our having had a crop, tnan at it's being very ſcanty.

" I may juſtly flatter myſelf that my ſucceſs will be ſtill greater in future years: my culture is improved by practice, my lands are brought into better tilth, my peaſants become accuſtomed to the new method, their repugnance to it leſſens, and I daily ſee faults of my committing, which now are leſſons to me.

"I was long perplexed about the proper time of plowing in the ſtubble: but various trials induce me now to think, that this ſhould be done immediately after harveſt. It is what I ſhall practiſe for the future, and I recommend it to all who follow the new husbandry. It cannot be done after ſowing, becauſe plowing then would bury the ſeed; and if it be performed only a little before ſeed time, the clods and ſtubble will neceſſarily obſtruct the operation of the drill-plough.

"My trials during theſe three years have convinced me, that the quantity of ſeed ſhould be diminiſhed in proportion to the goodneſs of the ſoil*. The contrary cuſtom prevails in this country, becauſe, ſay our farmers, the richer the land is, the more plants it can nouriſh: but my experience during theſe three years has invariably proved to me that this is a vulgar error."

The Editors of the laſt Edition of Mr. Tull's Horſe-hoeing Husbandry* give in their Preface to that work, the following comparative calculation of the expence and profit of the old method of culture and the new, drawn up by a gentleman who has practiſed both for ſome years, and who has no attachment to the new husbandry, farther than he has found it anſwer in his trials. They candidly appeal to experience, "whether every article in this calculation is not eſtimated in favour of the common husbandry; whether the expence be not rated lower than moſt farmers find it; and whether the crop be not ſuch as they would rejoice to ſee, but ſeldom do.

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* This is alſo Mr. Tull's opinion: "Poor land, ſays he, ſhould have more ſeed than rich land, becauſe a leſs number of the plants will ſurvive the winter on poor land. — The leaſt quantity of ſeed may ſuffice for rich land that is planted early; for thereon very few plants will die; and the hoe will cauſe a ſmall number of plants to ſend out a vaſt number of ſtalks, which will have large ears; and in theſe, more than in the number of plants, conſiſts, the goodneſs of a crop. — A too great number of plants do neither tiller, nor produce ſo large ears, nor make half ſo good a crop, as a bare competent number of plants. " *Horſe-hoeing Huſbandry*, *p.* 105.

* Printed in 1751.

“ In the new husbandry, every article is put at it's full value, and the crop of each year is computed four buſhels ſhort of the other; though, in ſeveral years experience, it has equalled, and generally exceeded thoſe of the neighbourhood in the old way.

“ *An Eſtimate of the Expence aud Profit of Ten Acres of Land in twenty Years.*

I. *In the Old Way.*

Firſt year, for wheat, coſts 33l. 5s. *viz.*	£. s. d.	£. d. s.
Firſt plowing, at 6 s. *per* acre	3 0 0	
Second and third *ditto*, at 8 s. *per* acre	4 0 0	
Manure, 30 s. *per* acre	15 0 0	
		22 0 0
Two harrowings, and ſowing, at 2s. 6d. *per* acre	1 5 0	
Seed, three buſhels *per* acre, at 4s. *per* buſhel	6 0 0	
Weeding, at 2 s *per* acre	1 0 0	
Reaping, binding, and carrying, at 6 s. *per* acre	3 0 0	
		11 5 0
		33 5 0
Second year, for barley, coſts 11 l. 6 s. 8d. *viz.*		
Once plowing, at 6 s. *per* acre	3 0 0	
Harrowing and ſowing, at 1 s. 6 d *per* acre	0 15 0	
Seed, 4 buſhels *per* acre, at 2s. *per* buſhel	4 0 0	
Weeding, at 1 s. *per* acre	0 10 0	
Cutting, raking, and carrying, at 3s. 2 d. *per* acre	1 11 8	
Graſs-ſeed, at 3 s. *per* acre	1 10 0	
		11 6 8
		44 11 8

	£. s. d.	£. s. d.
Third and fourth years, lying in graſs, coſt nothing: ſo that the expence of ten acres, in four years, comes to 44 l. 11 s. 8 d. and in twenty years to		222 18 4
Firſt year's produce is half a load of wheat *per* acre, at 7 l.	35 0 0	
Second year's produce is two quarters of barley *per* acre, at 1 l.	20 0 0	
Third and fourth years graſs is valued at 1 l. 10s. *per* acre	15 0 0	
So that the produce of ten acres, in four years, is	70 0 0	
And in twenty years, it will be		350 0 0
Deduct the expence, and there remains clear profit on ten acres in twenty years, by the old way		127 1 8

II. *In the New Way.*

	£. s. d.	£. s. d.
Firſt year's extraordinary expence is, for plowing and manuring the land, the ſame as in the old way		22 0 0
Plowing once more, at 4 s. *per* acre	2 0 0	
Seed, 9 gallons *per* acre, at 4s. *per* buſhel	2 5 0	
Drilling, at 7d. *per* acre	0 5 10	
Hand-hoeing and weeding, at 2s. 6d. *per* acre	1 5 0	
Horſe-hoeing ſix times, at 10s. *per* acre	5 0 0	
Reaping, binding, and carrying at 6s. *per* acre	3 0 0	
The annual charge on ten acres is	13 15 10	
Therefore the expence on ten acres in twenty years is		275 16 8
Add the extraordinaries of the firſt year, and the ſum is		297 16 8
The yearly produce is at leaſt two quarters of wheat *per* acre, at 1 l. 8 s. *per* quarter; which, on ten acres in 20 years amounts to		560 0 0
Therefore, all things paid, there remains clear profit on ten acres in twenty years by the new way		262 3 4

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"So that the profit on ten acres of land in twenty years, in the new way, exceeds that in the old by 135 l. 1 s. 8 d, and conſequently is conſiderably more than double thereof: an ample encouragement to practice a method whereby ſo great advantage will ariſe from ſo ſmall a quantity of land, in the compaſs of a twenty-one years leaſe; one year being allowed, both in the old and new way, for preparing the ground.

"It ought withal to be obſerved, that Mr. Tull's husbandry requires no manure at all, though we have here, to prevent objections, allowed the charge thereof for the firſt year; and moreover, that though the crop of wheat from the drill-plough is here put only at two quarters on an acre, yet Mr. Tull himſelf, by actual experiment and meaſure, found the produce of his drilled wheat-crop amount to almoſt four quarters on an acre: and, as he has delivered this fact upon his own knowledge, ſo there is no reaſon to doubt of his veracity, which has never yet been called in queſtion. But that we might not be ſuppoſed to have any prejudice in favour of his ſcheme, we have choſen to take the calculations of others rather than his, having no other view in what we have ſaid, than to promote the cauſe of truth, and the public welfare."

Experiments made near Guignes, *in the Province of* Brie, *under the direction of* M. Rouſſel, *and communicated to* M. Duhamel[b] *in* 1755.

M. Rouſſel prudently began, as we would advice every one to do, with ſmall experiments. His firſt trial of the new husbandry was upon a little ſpot: but being prevented from attending to it in perſon, many faults were committed during his abſence. On his return, which was towards the end of November 1754, he inquired after his crop, and learnt, with pleaſure, that ſome grains had produced upwards of 60 ears a-piece, and that many of theſe ears contained 64 grains. This was ſufficient to ſhew him the excellence of the new culture, which he immediately determined to extend to larger objects.

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[b] *Culture des Terres, Tom.* V. *p.* 84, *2e Edit.*

He had no time to loſe. Two contiguous pieces of ground, containing 24 acres, had been folded, and were juſt going to be plowed for the laſt time, in order to be ſown according to the uſual practice of the country. Theſe were choſen for the farther trial of the new husbandry, and were accordingly ſown with the drill-plough, between the ninth and twenty-firſt of October, with 571 pounds of wheat, including ten pounds and an half, which were uſed to fill up ſome ſpaces where the ſeed had miſſed. This is after the rate of about 24 pounds to an acre.

At the ſame time, an adjacent piece of ground which had been folded like the former, and of which the ſoil was equal to the beſt part of the field ſown in rows, was ſowed in the common way. This laſt contained four acres and a half, and took up, 486 pounds of ſeed, which is 108 pounds to an acre.

The corn came up finely in both fields: but that which was ſown in rows happened to be near a wood, from which numbers of rabbits came and entirely deſtroyed the plants of near five acres: the roots which they left, were eaten up by worms; and the dung of the ſheep-folds produced a great quantity of weeds. This was not all: as the furrows did not run in the direction of the declivity of the ground, the water lodged in them, ſo that the firſt plowing, which ought to have been given in March, could not be performed till April, when it left a great many clods.

Theſe clods were grown hard by the time of the ſecond plowing, which was performed with a plough with two mould-boards, which inſtead of breaking and looſening the ground, and laying freſh earth to the roots, only turned thoſe hard clods over upon the rows.

The third plowing, which was given with a plough with two ſhares, and in more favourable weather, had a better effect.

Notwithſtanding the accidents which had reduced this piece of wheat to ſo wretched a condition, that the huſbandmen ſaid they were ſure it never would produce a crop worth reaping, and that all the labour beſtowed upon it was thrown away; yet, reckoning upon the ſame footing of 24 acres, though it would be but juſt to deduct the five which were abſolutely deſtroyed by the rabbits; and ſuppoſing too the crops of 1756 and 1757 to be no greater than that of 1755; M. Rouſſel's calculation proves, that even theſe three crops will ſtill be better than what the ſame field would produce in the common way.

But, ſays M. Rouſſel, if we do the new huſbandry part of the juſtice it deſerves; and inſtead of including the five acres which the rabbits deſtroyed, we reckon only the produce of 19 acres prepared in a hurry, and badly plowed; and even ſuppoſe them to be no better managed in the following years, and the whole extent of the 24 acres, to be only of the ſame quality as the four acres and a half with which it was intended to be compared; the produce of both, in three years, will be as follows.

The 19 acres produced 11592 pounds of wheat, which was preferred to any other for ſeed, not only becauſe it was finer, but likewiſe becauſe it was quite free from all ſeeds of weeds. This is after the rate of 610 pounds for every acre.

From this, we are to deduct the ſeed, which is, for each acre, twenty-four pounds.

The neat produce of each acre will then be 586 pounds of wheat, free from all ſeeds of weeds.

Suppoſing the crops to be no greater in the following years, though what we ſhall ſay hereafter will ſhew that they certainly will, each acre will have produced neat at the end of three years, 1758 pounds of wheat.

The other piece of ground, which was cultivated in the old way, in order to make the compariſon, produced 1260 pounds an acre, from which we are to deduct 154 pounds for the ſeed.

The remaining neat produce is 1106 pounds.

The ſecond year's produce of this ſame acre, ſowed with ſpring corn, can be reckoned at only half the value of the firſt year's crop of wheat; and the third year produces nothing, being the year of fallow.

Thus the total neat produce of the acre cultivated in the common way will be, at the end of three years, only 1659 pounds; whilſt that in the new way, will be 1758 pounds.

M. Rouſſel *gives the following Account of his Experiments in* 1756, *in a letter to* M. Duhamel.

"IN October 1755, I choſe, in the middle of a fallow field which had been well plowed, and was not expoſed to any of the accidents I met with laſt year, * a piece of ground, which, to make a fair compariſon between the new method and the old, I divided into two equal parts, each containing 12 acres. One of theſe ſpots was ſet apart for the new huſbandry; and the other, exactly of the ſame quality, and quite contiguous, to be ſowed broad-caſt in the old way.

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* M. Duhamel rightly obſerves, that this change of ground was far from being an advantage to the new huſbandry.

"This laſt ground had been extremely well dunged by the folding of the ſheep. With regard to the other, which was to be cultivated in the new way, and which compoſed 93 beds five feet wide, including the alleys; only eight of theſe beds were dunged by ſheep, and that at the ſame time, and to the ſame degree as the ground by which the compariſon was intended to be made: of the other beds, 76 had no ſort of dung or amendment whatever; and nine were dunged more or leſs, in the manner and proportion hereafter mentioned.

"Moſt of thoſe who practiſe the new huſbandry uſe no dung at all. I ſuppoſed that their reaſon for rejecting this manure was, the difficulty of finding a proper time to apply it; for whilſt the alleys receive their ſeveral ſtirrings, no wheel carriage can be admitted with dung without hurting the beds which are ſown, and hardening the looſe mould of the alleys: to carry it on the backs of cattle, would be at beſt a very difficult, tedious, and expenſive way, where any conſiderable ſpace is to be dunged: to ſpread it upon the earth only the moment the ſeed is ſown, is a ſure way to clog up the drill-plough and hinder it's operation, if the dung be not thoroughly rotten; and to breed weeds, which by no means ſuit this culture. To remedy theſe inconveniencies, I contrived the following method. I opened in each of the alleys one of thoſe large furrows which muſt always be every year at the concluding of the ſummer hoeings, in the place where the three rows of ſeed are afterwards to be ſown; and by drawing the plough with two mould-boards once through it, I made it 14 or 15 inches wide; which is the breadth that the three rows of ſeed require. The ſpace between two of theſe deep furrows, is exactly the breadth of a cart, the wheels of which going in them, hurt no part that has been plowed, and do not preſs down or harden the looſe mould; nor do the horſes do any damage, becauſe they neceſſarily tread upon the ſtubble of the late reaped beds, in the middle between theſe two furrows. This was the method I uſed to dung the 9 beds in queſtion.* The dung was well rotted: it was ſpread at the bottom of the furrows, and immediately covered over by the ſame plowing that made the beds which were ſown ſome days after. Perhaps this manure may be of more ſervice to my lands than to many others, becauſe the ſoil is naturally cold and backward. The grain is by this means ſown upon a kind of gentle hot-bed, the warmth of which promotes the branching and vegetation of the plants. The winter rains and froſts, raiſe a fermentation. The firſt ſpring plowing, by giving it a little air, revives that fermentation at the very time when the ſap is moſt active, and the plant begins to branch. As the dung rots, a kind of motion is cauſed in the earth, which in ſome meaſure anſwers the end of a ſlight plowing, and brings freſh nouriſhment to the roots. The ſame heat as conſumes the ſtraw, likewiſe conſumes the little ſeeds that are in the dung, which might otherwiſe produce numbers of weeds. When this dung is brought up again to the ſurface of the earth, by the next year's plowings, it will no longer have thoſe hurtful ſeeds. It will indeed have loſt it's heat; but it will ſtill have retained all it's fatneſs, which will mix with the earth; and land thus conſtantly dunged, will in time become a perfectly fine mould. But if theſe layers of dung ſhould be ſpread too thick, or the dung itſelf be of too hot a nature, the roots of the corn might perhaps be endangered thereby. It was to determine this, that I tried the following experiments, to know the effects of different dungs, and what quantity it is proper to employ.

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* This, ſays M. Duhamel, is a contrivance of great importance; and I confeſs, adds he, that I have always been puzzled how to ſpread dung in the new huſbandry.

"Three beds were dunged, in the above manner, with horſe-dung: the firſt, which was 1165 feet long, had three loads of dung; the ſecond, of 1171 feet, had but two and a half; and the third, 1183 feet, had but two. Three other beds were dunged with cow-dung: one of 868 feet, with two loads and a half; the ſecond, of the ſame length, with two loads; and the third, of 874 feet, with only one load and a half. The three remaining beds had ſheep's dung: the firſt, of 842 feet, two loads; the ſecond, of 838 feet, one load and a half; and the third, which was of the ſame length, one load.

"Theſe beds were diſtributed in ſuch manner, that each of them was in the middle of two other beds which were not dunged. The field, thus laid out, was ſown on the thirteenth, fourteenth, fifteenth, and ſixteenth of October, with the drill-plough which plants three rows in each bed. I uſed 378 pounds of ſeed; and afterwards ten pounds to fill up the chaſms; which is after the rate of 32 pounds ſix ounces to an acre, and conſequently a little too much. Accordingly, when the corn came up, I ſaw it was too thick ſown. The reaſon was, that the grain was too ſmall, in proportion to the outlets of the drill-plough. At the end of ten days, this corn roſe well. On the eighteenth of December, I obſerved that moſt of theſe plants had branched into four ſtalks, whilſt thoſe in the common way had but three. I perceived no ſenſible difference then, between the dunged and the undunged beds. It was not till the twenty fourth of January that I ſaw plainly that the plants of the dunged beds were of a deeper green, and had made longer and more vigorous ſhoots than thoſe of the undunged beds. By the twentieth of February, five ſmaller ſtalks iſſued out of the five great ones, which was not the caſe with the wheat in the common way. The alleys did not receive their firſt plowing till the tenth of March. Eleven of the main ſtalks grew an inch and a half in five days; and I obſerved that the moles were rather more buſy in the dunged beds, than in the others. As the earth was yet ſomewhat too ſoft, I thought it needleſs to continue a plowing which could not do any good, and therefore poſtponed it to the twenty-eighth of March, and following days. On the ninth of April, I found a plant with 18 ſtalks in one of the dunged beds: the greateſt number of branches that any of the plants in the undunged beds had, was twelve: but on the other hand, I likewiſe found ſome which had eighteen in the field of compariſon ſown in the common way.

" On the ninth of May, this ſame plant had 20 ſtalks; and from that time it branched no more. The ſecond plowing was not given till three weeks after, *viz.* the twenty-eighth of May; which, I think, was ſomewhat too late after the corn had ceaſed to branch. By the twenty-third of June, there were three ſorts of wheat in all the beds: there were ears in bloſſom, others juſt going out of bloom, and others not yet out of their hoods. The fineſt ears were thoſe which came up and bloſſomed firſt. The moſt forward beds were thoſe which had been dunged under furrow with ſheep's dung: the next to them were the eight beds which had been folded, the plants of which were a little greener than thoſe of the undunged beds. The laſt plowing was given on the tenth of July. The grain had then begun to fill: but that in the common way was the moſt forward, though it was ſowed three weeks later than the other. I know not for what reaſon, the wheat of the new huſbandry began to be reaped on the fourth of Auguſt, and that in the old way was let ſtand till the thirteenth. The produce of both cultures was as follows.

" *In the twelve acres cultivated in the New Way, the three beds dunged with horſe-dung, yielded,*

	Sheaves.
The firſt, 1165 feet long, dunged with 3 loads,	19
The fellow to it, not dunged, . .	15
The ſecond, 1171 feet long, dunged with 2 loads and a half,	18
The fellow to it, not dunged, ...	14
The third, 1183 feet long, dunged with 2 loads,	16
The fellow to it, not dunged, . . .	13

The three beds dunged with cow dung, yielded,

The firſt, 868 feet long, and dunged with 2 loads and a half,	16
The fellow to it, not dunged, ...	11
The ſecond, likewiſe 868 feet long, and dunged with two loads,	15
The fellow to it, not dunged, . . .	12
The third, 874 feet long, and dunged with one load and a half,	14
The fellow to it, not dunged, . . .	12

The three beds dunged with ſheep's dung, yielded,

The firſt, 842 feet long, and dunged with 2 loads,	17
The fellow to it, not dunged, ...	10

	Sheaves.
The ſecond, 838 feet long, and dunged with one load and a half,	15
The fellow to it, not dunged,	11
The third, alſo 838 feet long, and dunged with one load	14
The fellow to it, not dunged, . . .	10

The eight beds which had been folded, two of which were

1171 feet long, three 1177 feet, and three 1183 produced in all,	142
This is near 18 ſheaves a-piece.	
The 67 other beds, which had not been dunged, produced in all	814
This is ſomewhat more than 12 ſheave apiece.	
Total produce of the 12 acres cultivated in the new way. . . . Sheaves	1208
The 12 acres ſown in the common broad-caſt way, after having been well folded all over, produced . . . . Sheaves	1820

" Theſe facts ſhew the advantage of dunging in this manner. It is plain that the beſt dung is that of ſheep, and that it is more profitable when laid under furrow, than when it is ſpread upon the ſurface of the ground by folding.

" In proportion to the produce of the bed 842 feet long, which was dunged with 2 loads of ſheep's dung, and produced 17 ſheaves; the bed 1165 feet long, which was dunged with three loads of horſe-dung, and produced only 19 ſheaves, would, if dunged with ſheep's dung, have produced $23 + \frac{69}{133}$; and the bed dunged with cow dung, which yielded but 16 ſheaves, would have yielded $17 + \frac{68}{133}$.

" The eight folded beds, whoſe whole length was 9412 feet, would have yielded 190 ſheaves $+ \frac{43}{133}$, inſtead of only 142 ſheaves, which was the amount of their product.

" It is likewiſe plain, that if the whole of my 12 acres in the new way had been dunged with ſheep's dung, as the bed 242 feet long was; I ſhould, in the ſame proportion, have reaped 1700 ſheaves, which would be but 120 ſheaves leſs than the whole produce of the 12 acres folded all over and ſown in the broad caſt way. But even then, I ſay, that thoſe 120 ſheaves would not be equivalent to the quantity of grain which I ſaved by ſowing according to the new huſbandry. An hundred of our ſheaves yielded, in general, little more than 378 pounds of wheat. The 120 ſheaves which the 12 acres ſown in the broad-caſt way produced more than the 12 acres in beds, would therefore yield but 453 pounds. Deduct this from 871 pounds, which I ſaved in the ſeed of theſe laſt 12 acres ſown in the new way, and I ſhall ſtill be a gainer : for I ſowed only 388 pounds in this ground ; whereas 1260 pounds were uſed to ſow the other 12 acres in the common way. This would have been the produce of this firſt year's crop, ſuppoſing that the whole of my 12 acres in beds had been dunged in the ſame manner as the bed 843 feet long. For want of that, I reaped but 1208 ſheaves. They have juſt been threſhed, and have yielded only 5040 pounds of grain."

M. Duhamel makes the following remarks on this account of M. Rouſſel.

" The 1208 ſheaves yielded but 5040 pounds of grain; from which we are to deduct 388 pounds for the ſeed. The neat produce is therefore 4652 pounds, which would make in three years 13956 pounds. The other field in the common way produced 8757 pounds; from which we are to deduct 1260 pounds for the ſeed : the neat produce is conſequently 7497 pounds ; the half of which is 3748 pounds and a half, for the value of the next year's crop. This is all that the 12 acres in the common way would produce in three years, and amounts to no more than 11245 pounds and a half: conſequently the balance in favour of the new huſbandry, in three years, is 2710 pounds and a half, or one fourth part of the whole; and that from a field which was ſown in rows for the firſt time, and of which three fourths were not dunged at all: whilſt the other, with which it is compared, had been folded all over, and, for the year, produced a very plentiful crop."

Experiments on Smyrna Wheat, *communicated to* M. Duhamel.

"SMYRNA wheat has a very large ear, with ſeveral leſs, or collateral ears, growing out of, or round that large one. It requires a great deal more nouriſhment than the common huſbandry will afford; for there it's ears grow very little bigger, and produce little, if any, more grain than thoſe of common wheat[†]. In all probability, it will do much better when cultivated according to the new method[*]: but the experiments which have hitherto come to our knowledge are very few. The following is the chief, and indeed the only one worth mentioning.

[†] Count de la Galiſſoniere, ſays M. Duhamel, ſowed ſome of it for ſeveral years: it produced a little more grain than common wheat; but the bread made of it was not ſo good. *Culture des Terres, Tom.* I. *c.*16. *p.* 206, 2*e Edit.*

[*] Mr. Tull was of the ſame opinion. " As this, ſays he, is the largeſt of all ſorts of wheat, ſo it will diſpenſe with the nouriſhment of a garden, without being over-fed, and requires more nouriſhment than the common huſbandry will afford it; for there it's ears grow not much bigger than thoſe of common wheat. This I believe to be, for that reaſon, the very beſt ſort for the horſe-hoeing huſbandry: next to this, I eſteem the white-cone wheat, then the grey-cone. I have had very good crops from other ſorts; but look upon theſe to be the beſt.—I judge that two gallons of Smyrna wheat will be ſeed enough for an acre, eſpecially if planted early, and drilled in ſingle rows. — There is another ſort of wheat which has many little ears

" M. Le Vayer, maſter of requeſts, ſowed ſome of this wheat in 1751, in a ſmall part of his eſtate at Duviere, in the province of Maine, and had a very good crop[a]. He ſowed it again in 1752, in the common way; and though it did not anſwer near ſo well this time, it yielded him a third more than common wheat would have done.

" In order to try how this wheat can be cultivated to the beſt advantage, M. Le Vayet ſowed ſeven pounds and an half of it, in November 1752, in two pieces of ground which had formerly been a kitchen garden, and of which the ſoil was good and deep[b]. It came up well, and the plants were very fine till July, when heavy rains fell, which laid them quite flat. The great heats which came on immediately after, raiſed them but very imperfectly. However, notwithſtanding all this, the grain filled and ripened perfectly: but, though the year was very forward and extremely hot, this corn could not be reaped till near three weeks after the common wheat. It produced thirty one ſheaves, which yielded ſeven buſhels of 60 pounds, that is to ſay, 420 pounds in all; which is 56 for one. If this ground had been ſown according to the common

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ears coming out of the two ſides of the main ear; but it does not ripen till very late, ſucceeds not well in this country, nor is it liked by thoſe who have ſown it: yet I have had ſome ears of it by chance among my drilled wheat, where they have been larger and finer than thoſe of any common ſort." *Horſe-hoeing Huſbandry, p.* 104, *and* 137. 3*d Edit.* M. Duhamel agrees with Mr. Tull, that the white cone and the grey cone wheat are the beſt of all the ſorts commonly ſown. *Culture des Terres, Tom.* I. *p.* 207. 2*e. Edit.*

[a] *Id. ibid. Tom.* II. *Part.* 3. *c.*1. *p.* 346.

[b] *Id. ibid. Tom.* III. *c.*1. *p.*39.

method of the country, it would have taken up fifty pounds of ſeed; and, good as the ſoil was, it's produce would not have been more, even in the beſt of years, according to the general run of the crops of this country.

"The reſult of this experiment," ſays M. le Vayer, "ſeems to contradict the theory of the "new huſbandry, which promiſes that the ſtalks "of wheat cultivated in the new way, being leſs "crowded, and more expoſed to the air, will be "ſtronger and leſs apt to be lodged, than that "which is ſowed in the common way. It is likewiſe to be obſerved that the common wheat, "ſown according to the old method, was not "lodged at all this year, but kept quite upright, "though it ſuſtained the ſame rain as the other. "The bigneſs of the ears of the Smyrna wheat, "which makes them the more apt to retain wet, "may have occaſioned this difference. However, "M. du Verger, who, the ſame autumn, and laſt "ſpring, ſowed common wheat, ſpring corn, and "barley, in rows, found that neither of theſe "grains ripened till long after thoſe of the ſame "ſpecies ſown in the common way, and that all of "them were lodged. That excepted, his crop was "good. But if the ſame accident ſhould happen "every year, it might be feared that the grain "would not be able to ripen thoroughly, eſpecially in cold wet years. This is, perhaps, an "inconvenience in the new huſbandry, to which "cold countries may be more ſubject, than thoſe "that are warmer."

This, as M. Duhamel obſerves, cannot be known, but by a ſeries of experiments: "for, adds he, we ſee that the corn ſown in the new way has been reaped, in many places, almoſt as early as any other, when care has been taken to ſow it ſooner. It has been prevented from lodging,

ing, by turning the earth, of the alleys over towards the rows."

M. du Verger, who lives at Mans, having communicated his experiments to M. Duhamel, this laſt obſerves, that they were made on very ſmall ſpots of ground from which no concluſion can be drawn, becauſe the borders of a field are almoſt as favourably ſituated as the beds of the new huſbandry, for the roots of plants to extend themſelves in queſt of their food: this is the reaſon why the plants near the foot paths in corn fields are always the fineſt: now it is very plain that the outſide borders of a very ſmall ſpot of ground are a conſiderable part, in compariſon of the whole; and therefore it's produce cannot juſtly be compared with that of another ſmall ſpot ſown in rows.

Experiments made in France *on Wheat of different countries, as related by* M. Duhamel[c].

"IT would be wrong, ſays M. Duhamel, to ſuſpect us of having no other view, than merely to extol the new huſbandry. The only reaſon that induces us to dwell ſo much upon it, is, that we think it may be extremely profitable in ſome caſes, and very uſeful in others. Whatever is capable of promoting the progreſs of agriculture, is equally intereſting to us. With this view, we applied to the factors of our Eaſt-India company for ſamples of the different kinds of wheat of the countries where they reſide. They were ſent to M. de Réaumur, who was ſo kind as to deliver them to me. I ſhall ſay, in a moment, what uſe I made of them. The late Marquis de la Galiſſoniere had before given me a pretty large quantity of a wheat which he had brought from Spain, and which he knew made the beſt bread of any in Europe. At the ſame time, the Marquis de Gouvernet gave me a ſample of a large grained ſpring wheat, which was ſaid to multiply exceedingly.

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[c] *Culture des Terres, Tom.V. p.* 236.

"I was the more pleaſed with having theſe ſamples, as I am perſuaded that many of the different kinds of wheat which are generally cultivated in moſt countries, may, by reaſon of the ſoil or other phyſical cauſes, not be ſo fit as ſome other ſorts might be, to produce the moſt plentiful crops, or to make the fineſt bread. Few counties, or indeed few countries, cultivate more than two or three kinds of wheat; and the generality of farmers have ſo little curioſity, that they do not ſo much as think of trying whether any of the ſpecies that are cultivated in other countries, would not be preferable to thoſe they uſe.

"An attentive traveller may obſerve that the wheat which grows in the different countries he goes through, is not all alike: but he contents himſelf with making this obſervation in general, without conſidering that he would do his own country, or his own county, an eſſential ſervice, by bringing into it a better ſort of corn. 'Tis true, this might perhaps be attended with ſome little trouble: to avoid which, moſt people are very ready to perſuade themſelves that thoſe more perfect kinds of wheat would not anſwer in another ſoil than their own, or that they would ſoon degenerate in it. For my part, I am thoroughly ſatisfied, that improvements of this kind, ought by no means to be looked upon as objects of ſmall importance, and that it is right to try the culture of different kinds of grain, in hopes of meeting with ſome which may deſerve to be preferred to that which it is the cuſtom to ſow. Doubtleſs, many might not ſucceed. Accordingly, I was not at all ſurpriſed at the poor condition to which the wheat I received from Suratte and Bengal, and which I ſowed in autumn and in the ſpring, was reduced. Thoſe climates are ſo different from ours, that I could not well expect any better ſucceſs.

" The Spaniſh wheat, which M. de la Galiſſoniere gave me, and which I ſowed in autumn, roſe well; and the winter being very mild, it made a fine appearance till near Whitſuntide: but then, it dwindled away on a ſudden, and afforded ſcarce any crop at harveſt. The caſe was different with ſome of the ſame wheat which I ſowed in March. Notwithſtanding the too frequent rains, which hurt every other kind of wheat, this was equal to the very fineſt corn, and yielded an excellent grain, as hard, and tranſparent, as if it had grown in Spain. The whole produce of this crop is ſet apart, to be ſowed next ſpring. This ſame corn was tried, with exactly the ſame ſucceſs, at Digny, and at Denainvilliers.

" The ſpring wheat which I had from M. de Gouvernet, ſuffered more from the intemperature of the ſeaſons, than the Spaniſh wheat. It's grain was ſhrivelled. However, I keep it for next year.

" I ſent ſome of each of theſe kinds of wheat to M. le Vayer, who ſowed them, and after harveſt wrote to me as follows.

" A pound and an half of Spaniſh wheat (the " Marquis de la Galiſſoniere's) ſown in autumn, " produced five pounds and an half of clean grain. " This wheat was as fine as that we are going to " ſpeak of. The ſcantineſs of the crop was owing " to the birds that preyed upon it.

" The ſame quantity of the ſame wheat, ſown in the ſpring, produced ſixteen pounds of very clean grain.

" Half an ounce of large grained ſpring wheat " (the Marquis de Gouvernet's) ſown on the 11th " of October, produced only two ounces and an " half of grain, and that bad.

" Another half ounce ſown in the ſpring, roſe " well; but not being able to bear the almoſt " continual rains, it produced nothing.

" Two ounces of Suratte wheat ſown in Octo- " ber, produced but three pennyweights of a " very light and meagre grain.

" Two ounces of the ſame wheat ſown in " March, roſe well, but bore no ears.

" Two ounces of Bengal wheat ſown in Octo- " ber produced twenty ounces of pretty fine grain.

" Two ounces of the ſame wheat ſown in " March, produced but three ounces."

" It is to be obſerved, that the ſoil in which theſe different grains were ſown, though good, is clayey. M. le Vayer gave the preference to a ſpot of this kind, not only becauſe he judged it to be the moſt proper, and it was new ground, but likewiſe becauſe it's expoſition was due ſouth, and it was ſheltered on the north ſide by a high wall. All this ſeemed very proper for a grain which came from ſo very hot a country: and perhaps it might be owing to this precaution that the Bengal wheat ſucceeded better with M. le Vayer, than at Denainvilliers.

" The Suratte wheat, which is reaped in the iſle of Bourbon four months after it is ſown, did not ripen with M. le Vayer till eight or ten days before the common wheat, though it was ſown in autumn. It is not to be doubted, but that if the ſummer had been warm and dry, theſe grains would have ſucceeded better, and eſpecially that which was ſowed in the ſpring; and probably that which was ſowed in autumn, would have periſhed in the winter, if that ſeaſon had not been extremely mild."

Expe-

Experiments on Barley, Oats, and Rye, *communicated to* M. Duhamel.

Experiments made near Bourdeaux, *by* M. Navarre, *Dean of the Court of Aids.*

ON the thirteenth of December, 1751[d], M. Navarre ſowed four beds, two with wheat, one with rye, and the fourth with barley. The beds were 24 feet long, and, with the alleys, ſix feet wide. The grains were ſown at the diſtance of eight inches from one another; and each bed had three rows, which were likewiſe eight inches aſunder.

The wheat appeared long before the rye and barley, and ſuffered greatly by inſects, which not only eat numbers of ſhoots too or three inches long, cloſe to the ground, every day, but alſo attacked the roots and the grain in the earth. Diſguſted by this incident, he gave up this ſpot, concluding it would not come to any thing. The rye and barley came up much later.

However, he was ſurpriſed afterwards to find ſeveral plants of wheat, ſome of which had upwards of 60 ſtalks, with long ears. The rye and barley were leſs damaged. The rye had, in general, from 50 to 55 tall well eared ſtalks; and one of the plants of barley had 101 ſtalks.

He remarked particularly, that, in all theſe beds, the middle row branched leaſt and was much the weakeſt: whence he concluded, that it would be beſt to make the beds only four feet wide, and to ſow but two rows in them, and thoſe a foot aſunder; an alley of three feet being ſufficient to admit the ſummer plowings with one bullock.

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[d] DUHAMEL, *Culture des Terres, Tom.* II. *p.* 353. *2e. Edit.*

M. Diancourt, another of M. Duhamel's correſpondents, ſowed eight perches of ground with oats, in double rows, with alleys ſix feet wide. Even the moſt prejudiced againſt the new huſbandry acknowledged that there was more grain in one of thoſe double rows, than on eight perches ſown in the common way.

Experiments made at Avignac in Britany, by M. de Brue[f].

M. De Brue ſowed, with winter oats, part of a field which had been reſted, but brought to a fine tilth, and was of a light ſoil. The ſeverity of the cold having deſtroyed the oats, he plowed it up again in March, for ſpring oats, which were very fine. Moſt of the ſtalks were five feet high.

He left untouched a ſmall corner, where he perceived ſeveral plants of the winter oats, which the froſt had not deſtroyed. Though this ſpot had been expoſed to the trampling of cattle, and promiſed but little from the beginning, M. de Brue was ſurpriſed at the beauty of theſe oats, and at the quantity they yielded. The ſtraw was ſix feet high, and loaded with very fine grain. " It is " true, ſays he, I believe I was partly indebted for " this ſucceſs to the dryneſs of the ſeaſon: for " the ground I am ſpeaking of is frequently over- " flowed in wet years, notwithſtanding all the " pains I have taken to drain it.

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[f] DUHAMEL, *Culture des Terres, Tom.* IV. *p.* 30, 2*e Edit.*

" In the month of Auguſt," continues this gentleman, "I plowed up another field which had " juſt borne hemp, and made it into beds 10 or " 12 feet wide. In the beginning of September, " I ſowed it with about 120 pounds of rye, which " came up very thick. I mowed it three times, " before it ſpindled, and got fifteen thouſand " weight of green fodder, which was of great ſervice to my cattle; the ſeverity of the winter " having left very little graſs on any paſture " grounds.

" This fodder purges and nouriſhes cattle. The " cows that were fed with it gave plenty of milk, " which made excellent butter. Many farmers, " who ſaw what I did, intend to follow my example. I let the fourth ſhoots of this rye grow up " to ſeed. The ears were very ſmall, and yielded " me nearly the quantity I had ſown.

Mr. Miller as was obſerved before[f], commends the practice of ſome parts of England where rye is ſowed purpoſely for fodde. " Rye, " ſays he[g], is ſown in autumn, to afford green " feed for ews and lambs in the ſpring, before " there is plenty of graſs. When this is intended, " the rye ſhould be ſown early in autumn, that " it may have ſtrength to furniſh an early feed. " The great uſe of this is to ſupply the want of " turneps in thoſe places where they have failed, " as alſo, after the turneps are over, and before " the graſs is grown enough to ſupply green food " for the ewes; ſo that in thoſe ſeaſons, when the " turneps in general fail, it is very good huſbandry to ſow the land with rye, eſpecially where " there are ſtocks of ſheep, which cannot be well " ſupported, where green food is wanting early in " the ſpring."

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[f] *Vol.* I. *p.* 372.

[g] *Gardener's Dict.* Art. SECALE.

Extract of a letter from a gentleman in Poitou[h]

" BEING convinced of the advantages of the new method of cultivating land, I reſolved to make a trial of it, by comparing the produce of a field cultivated in the common way, with that of another field cultivated according to the new huſbandry: and as M. Duhamel has deſired all lovers of agriculture to try by experiments made with care, whether it be moſt profitable to ſow beds, with two, or with three rows of corn; or, which is the ſame thing, to find at what diſtance the rows ought to be ſown; I divided a ſpot of ground into ten equal parts, which I made into as many beds, each ſix feet wide.

" In the middle of five of theſe beds I ſowed three rows, ſeven inches aſunder; ſo that they took up fourteen inches of ground, and there remained four feet ten inches for the breadth of the alleys, which is very ſufficient for the horſe-hoeing huſbandry.

" I ſowed three other beds with only two rows, a foot diſtant from each other: conſequently the alleys were five feet wide.

" The two remaining beds were ſown with two rows each, three feet aſunder. The alleys were therefore but three feet wide: or rather, the whole of this laſt ſpot may be looked upon as ſown in ſingle rows, with alleys three feet wide, which is too narrow a ſpace to admit of horſe-hoeing them conveniently.

" Before I ſpeak of the produce of theſe beds, it will be proper to obſerve:

" 1. That this trial was made with rye. My fear that birds might eat up the wheat, made me prefer rye; which I adviſe every one to do, when only ſmall experiments are made. This eſcaped without the leaſt damage: whereas I have obſerved, that when experiments have been made with wheat, the birds, preferring that to any other grain, have always deſtroyed a conſiderable part of the crop.

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[h] DUHAMEL, *Culture des Terres*, Tom. IV. *p.* 39.

" 2. The beds ſown with three rows were near a hedge, which greatly damaged two of them; either by it's roots exhauſting the ground, or by it's ſhadow keeping that part harder frozen than the reſt.

" 3. The intervals were not hoed at all, between either the double or the triple rows: only the alleys were horſe-hoed; and conſequently none but the ſingle rows were hoed on both ſides.

" 4. On the twenty fifth of February, the alleys were plowed. I viſited them on the ſecond of March; and found, upon examining the plants, that, in theſe five days, they had ſhot out roots four inches long into the new-ſtirred mould. I repeated the hoeings at proper times, and the rye continued in good condition 'till it was reaped. The laſt hoeing was given after the bloſſoming was paſt.

" 5. I then examined the roots, and found they had extended eighteen inches into the looſe mould. This may ſeem ſtrange, but I am certain it is true, for I took every precaution not to be deceived.

" 6. The alleys between the ſingle rows were hoed but twice, being too narrow to admit the plough after the plants had begun to branch. However, I had no reaſon to complain of the produce of theſe ſingle rows.

" Having now given an account of my operations, it is time to ſpeak of the products.

“ The ears in my rows were from four to ſeven inches long, and the ſtalks from four to ſix feet high; which was one third taller than in the neighbouring fields cultivated in the old way.

“ This ſpot of ground, in the beſt years, never produced more than five buſhels, including the buſhel of ſeed corn; for that was the quantity generally uſed: in common years, it has not yielded above four buſhels, and frequently much leſs. We therefore cannot reckon it’s produce, one year with another, at more than four buſhels, including all faulty grains and ſeeds of weeds, which fall through the ſieve, and remain mixed with the good grain. This year it has yielded me ſeven buſhels of fine clean rye, conſiderably larger than the common ſort. I make no account of the ſeed, the quantity was ſo ſmall. To prevent this grain’s being mixed with any other, and at the ſame time to judge more exactly of the produce of my ground, I had the ſheaves threſhed out cloſe by the field: but it was in the middle of a road, where all the grains ſcattered by the flail could not be gathered up: by which I reckon I loſt more than the amount of the ſeed that was ſown in the rows. The produce of my little field was therefore this year, compared to other years, as ſeven is to four: to which muſt be added, that it is capable of bearing as great a crop every year; which is not the caſe in the common huſbandry.

“ Let us now examine the produce of the rows, and compare them with one another, in order to judge whether it be moſt profitable to ſow in ſingle, double, or triple rows.

“ Two beds, the moſt diſtant from the hedge, ſown with triple rows, yielded each three quarters of a buſhel.

“ Two beds with double rows, yielded each two thirds of a buſhel: conſequently the three beds with double rows yielded two buſhels, and the ſix rows ſown two and two, in three beds, yielded one quarter more than the ſix rows ſown three and three in two beds: but two beds of three rows a-piece yielded one-ninth more than two beds of only two rows a-piece: whence we may conclude, that the diſtance of the rows increaſes the produce of an equal number of plants; or, which comes to the ſame, that an equal quantity of ſeed will produce more grain when the rows are more diſtant, than when they are ſown cloſer together. But this is not a real profit; becauſe the ſix double rows take up one-third more ground than the ſix triple rows.

"Each of the ſingle rows yielded ſeven-eighths of a buſhel, which is one-ſeventh more than the triple rows, though they took up no more ground; and their produce would probably have been greater, if they had been hoed two or three times more.

"It appears by this account, that the profit would probably have been on the ſide of the double rows, if the alleys had been made only four feet wide, inſtead of five: for by this means I ſhould have gained one-fifth more ground, and four feet are a ſufficient breadth for the operations of the horſe-hoe. Where the ſingle rows are ſo near as in this experiment, the ſame ground would ſcarcely bear another crop the next year, for want of having been ſufficiently ſtirred. To clear up this point by a new experiment, I have ſown ſingle rows in the middle of four beds, two of which are four feet wide, and the two others only three. The winter hoeings have been given them with eaſe, and I hope the others will not be more difficult; at leaſt till all the corn is ſpindled. What I fear moſt is, the earth's being carried off the narrow ſpace on which the rows ſtand, when a thaw comes on, or by the heavy rains which are frequent with us*.

"The reſt of my field is ſowed in two rows, in beds four feet two inches wide. I have done this, becauſe, as it is the general cuſtom here to make our ridges about that breadth, I am in hopes that if I obtain a plentiful crop, I ſhall be able the more eaſily to prevail on the farmers of this country to adopt a method, the advantage of which I was ſenſible of, even before I tried the above experiments."

Experiment on Barley, *by his Excellency* M. Bielinſki, *grand Marſhal of Poland.*

M. Bielinſki gives the following account of this experiment, in a letter to M. Duhamel[1].

"On the 11th of May, I plowed and made into beds, with our common plough, about ſix hundred ſquare perches of a large field near the gate of my caſtle. This ſituation gave me an opportunity of overſeeing the work.

"The ſoil is very good, neither too ſtrong nor too light; and as it was near my ſtables, it had been dunged frequently. It bore wheat the preceding year, and had been plowed twice after harveſt. I ſowed it with barley on the 12 of May, with the drill plough. It took 159 Paris pints, and would have required about 720, if it had been ſown in the common way: conſequently here was a ſaving made of near three-fourths of the ſeed.

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* Theſe accidents, ſays M. Duhamel, may be prevented, by making the furrow in the middle of the alleys at a greater diſtance from the rows: the water will then be drained off, without hurting the plants; and in March, the horſe-hoe may be brought almoſt cloſe to the rows, to looſen the mould about the roots, without any fear or danger.

[1] *Culture des Terres*, *Tom.* V, *p.* 118.

"On the firſt of June, the barley ſeeming ſtrong enough, I horſe-hoed the alleys for the firſt time, with a light plough. The beds were but four feet wide; deducting from which eight inches, for the ſpace on which the barley grew, there remained three feet four inches for the alleys, which I at firſt thought very ſufficient for all the neceſſary hoeings: but notwithſtanding all the care that could be taken, ſome parts of the rows were carried off by the plough, and others were covered with earth. At leaſt one ſixth of the crop was loſt by this accident. During all June, and part of July, my barley promiſed well, and branched conſiderably. Every plant that I examined had from 12 to 20 ears, which were eaſily diſtinguiſhed from the barley ſown in the common way, by their largeneſs, and the deep green colour of their blades.

"The ſecond and third hoeings were performed on the 12th of June and the 15th of July, with the cultivator, which did not damage the rows ſo much as the light plough had done.

"July was an exceeding hot month. By the 15th, the plants ſeemed to ſuffer by it, and the extreme ſultry heat of the laſt days of that month put an entire ſtop to their vegetation. They languiſhed afterwards, and the lower ſtalks withered before the grain was well formed. Birds too preyed upon it: ſo that I was forced to cut it down in the beginning of Auguſt. To complete the misfortune, it rained inceſſantly for five days after this corn was cut, which made many of the ears ſprought in the rick. Notwithſtanding all theſe accidents, my crop yielded 5139 pints of good clean barley: which is as much as I could have expected in a middling year, if the field had been ſown in the common way.

"The crop would certainly have been greater, 1. If I had ſowed the barley ſooner; the heat having hurt only the late ſown grain: and, 2. If the beds had been larger: for then the ſummer culture might have been given to the alleys more conveniently, and without tearing up or burying any part of the rows."

Among many other experiments communicated by different correſpondents, M. Duhamel mentions the following made on oats, in a climate reſembling that of Provence, as an inſtance of the advantage of ſowing thin.

A field, bordering on a meadow, was ſowed with oats. The owner, before he ſowed it, dug a ſmall ditch of eight or ten inches between this field and the meadow, to carry off the water intended for watering the meadow. The earth thrown out of this ditch was laid on the ſide of the field, where it made a little bank 18 or 20 inches wide, on which oats were ſown, as on the reſt of the field, which had been well plowed. Some grains of oats fell along the ſloping ſide of this bank, next to the ditch, and, in general, at the diſtance of ſix, ſeven, or eight inches from one another. They produced 18, 20, and 25 ſtalks a piece, taller and ſtronger than thoſe which grew upon the bank, though theſe were much ſuperior to any in the reſt of the field.

"To be the more exact in my compariſon, I picked out one of the fineſt ſtalks I could find in each of theſe three places. That which I took from the middle of the field was two feet five inches and one-third long, and had 91 grains of oats on it: that from the top of the bank was three feet nine inches and one-ſixth in length, and bore 165 grains: and that from the ſide of the bank next the ditch was four feet nine inches long, and yielded 214 grains. The ſtraw of this laſt was much ſtronger, and the grain larger and better filled, than any that grew in the field. The difference was ſo great, that I am perſuaded a third fewer of theſe grains would have filled a buſhel, than of the others."

Mr. Miller is ſo ſenſible of the advantage of ſowing thin, that he ſtrongly recommends to farmers, inſtead of four buſhels, which is the common allowance of barley, to an acre, to ſow even leſs than half that quantity: "There will, ſays he[k], "be a much greater produce, and the corn will "be leſs liable to lodge, as I have many years "experienced: for when corn or any other vegetable ſtands very cloſe, the ſtalks are drawn up "weak, and are incapable to reſiſt the force of "winds, or bear up under heavy rains: but when "they are at a proper diſtance, their ſtalks will "be more than twice the ſize of the other, and "therefore are ſeldom laid. —— I have ſeen experiments made by ſowing barley in rows a-croſs "divers parts of the ſame field, and the grains "ſowed thin in the rows, ſo that the roots were "three or four inches aſunder in the rows, and "the rows a foot diſtance: the intermediate ſpaces "of the ſame field were at the ſame time ſown "broad-caſt in the uſual way. The ſucceſs was "this: the roots which ſtood thin in the rows, "tillered out from ten or twelve, to upwards of "thirty ſtalks on each root: the ſtalks were "ſtronger, the ears longer, and the grains larger "than any of thoſe ſown in the common way; "and when thoſe parts of the field where the "corn ſown in the uſual way has been lodged, "theſe parts ſowed thin have ſupported their "upright poſition againſt wind and rain,

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[k] *Gardener's Dict.* Art. HORDEUM.

" though the rows have been made not only " length ways, but croſs the lands in ſeveral " poſitions, ſo that there could be no altera- " tion in regard to the goodneſs of the land, or " the ſituation of the corn: therefore where ſuch " experiments have been frequently made, and " always attended with equal ſucceſs, there can " be no room to doubt which of the two methods " is more eligible, ſince if the crops were only " ſuppoſed to be equal in both, the ſaving more " than half the corn, is a very great advantage, " and deſerves a national conſideration, as ſuch a " ſaving, in ſcarce times, might be a very great " benefit to the public.

" I know the farmers in general are very apt to " complain if their corn does not come up ſo " thick as to cover the ground green in a ſhort " time, like graſs fields: but I have often obſerv- " ed that when from the badneſs of the ſeaſon it " has come up thin, or by accident has been in " part killed, their corn has been ſtronger, the " ears longer, and the grain plumper; ſo that the " produce has been much greater than in thoſe " years when it has come up thick: for the " natural growth of corn is to ſend out many " ſtalks from a root, and not to riſe ſo much in " height: therefore it is entirely owing to the " roots ſtanding too near each other, when the " the ſtalks are drawn up tall and weak. I have " had eighty ſix ſtalks upon one root of barley, " which were ſtrong, produced longer ears, and " the grain was better filled than any I ever ſaw " grow in the common method of huſbandry, and " the land upon which this grew was not very " rich: but I have frequently obſerved on the " ſides of hot-beds in the kitchen gardens, where " barley ſtraw has been uſed for covering the " beds, that ſome of the grains left in the ears, " have dropt out and grown, the roots have pro-

"duced from thirty to ſixty ſtalks each, and thoſe "have been three or four times larger than the "ſtalks ever arrive at in the common way. But "to this I know it will be objected, that although "upon rich land in a garden, theſe roots of corn "may probably have ſo many ſtalks; yet in poor "land they will not have ſuch produce; therefore "unleſs there is a greater quantity of ſeeds ſown, "their crop will not be worth ſtanding; which is "one of the greateſt fallacies that can be imagined: for to ſuppoſe that poor land can nouriſh "more than twice the number of roots in the "ſame ſpace as rich land, is ſuch an abſurdity, as "one could hardly ſuppoſe any perſon of common underſtanding guilty of: and yet ſo it is; "for the general practice is to allow a greater "quantity of ſeed to poor land, than for richer "ground; not conſidering that where the roots "ſtand ſo cloſe, they will deprive each other of "nouriſhment, and ſo ſtarve themſelves; which "is always the caſe where the roots ſtand cloſe, "as any perſon may at firſt ſight obſerve in any "part of the fields where the corn happens to "ſcatter when they are ſowing it; or in places, "where, by harrowing, the ſeed is drawn in "heaps, thoſe patches will ſtarve, and never grow "to a third part of the ſize as the other parts of "the ſame field: and yet, common as this is, it "is little noticed by farmers; otherwiſe they "ſurely would not continue their old cuſtom of "ſowing. I have made many experiments for "ſeveral years in the pooreſt land, and have always found that all crops which are ſown or "planted at a greater diſtance than uſual, have "ſucceeded beſt; and I am convinced that if the "farmers could be prevailed on to quit their pre-"prejudices, and make trial of this method of "ſowing their corn thin, they would ſoon ſee the "advantage of this huſbandry.

"The noblemen and gentlemen in France are "very buſy in ſetting examples of this huſbandry "in moſt of their provinces, being convinced of "it's great utility, by many trials: and it were "to be wiſhed the ſame was done in England."

Experiments on

Leguminous Plants,

communicated to M. Duhamel.

IN April 1753, M. de Villiers ſowed 80 ſquare perches, of 22 feet each, with peas, in double rows[1]. Not being provided with any inſtrument to hoe the alleys, he made uſe of a narrow angular kind of ſhare, which ſtirred only three or four inches on the outſide of the rows. Almoſt all the peas in that country were deſtroyed this year by a kind of vermin called vine-fretters. His were hurt the leaſt of any; which was probably owing to the greater vigour of the plants, or to the inſects being killed by the ſtirring of the ground. By a compariſon which he made of the produce of this ſpot, he found that it yielded ſix times as much as the ſame extent of the beſt land in thoſe parts. In a good year, the difference would not have been ſo great: but ſtill this experiment ſhews, that plants cultivated in the new way are better able to reſiſt the inclemencies of the ſeaſons, and other accidents, than thoſe which are cultivated according to the old method.

The next year, being provided with M. Duhamel's drill and horſe-hoe, he ſowed peas, and barley. Some of the alleys were but two feet wide, and the others but two feet and an half, which rendered the horſe-hoeing very difficult in many places, and quite impracticable in others. This obliged him to contrive other methods of ſtirring the ground. The peas flouriſhed extremely, and produced more than the very beſt fields thereabouts. The barley, though ſown too thin, yielded likewiſe more than that of any other field.

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[1] DUHAMEL, *Culture des Terres, Tom.* IV. *p.* 55.

In December 1755, he ſowed peas in a ſtrong heavy ſoil, where no one had ever ventured to ſow any in the common huſbandry [m]. They grew as high as if the ground had been ever ſo fit for them, and yielded half as much again as any ſown in the common way, beſides the ſaving in the ſeed, which, in peas, is about one half. They were ſown in double rows, and the allies, which were two feet, and two feet and an half wide, were hoed with the ſingle cultivator. Lentils ſucceeded admirably well in this method [n], and potatoes, parſneps, carrots, cabbages, &c. of the culture of which, both for the table and for fodder, farther notice will be taken in the next volume of this work, yielded amazing crops when managed according to the principles of the new huſbandry.

M. Eyma, of Bergerac, near Bourdeaux, ſowed peas, beans, and kidney-beans, each ſeed a foot diſtant from another in the rows, and the rows two feet aſunder. They yielded a much greater crop than any in the common huſbandry [o].

In December 1755, he planted the common ſort of garden-beans, in a middling ſoil, not dunged, but extremely well plowed a foot deep [p]. The rows were two feet aſunder, and the plants a foot diſtant from each other. Theſe beans, which every one thought much too thin ſown, being aſſiſted by frequent hoeings, yielded a greater crop than any in the common way. M. Eyma, finding his beans begin to ripen, gave the alleys a good plowing, and, on the twenty-third of June, ſowed in each of them a row of red kidney-beans, which came up very well. A fortnight after, he plucked up the garden-beans, and gave the earth they grew on a ſlight hoeing. The kidney-beans proved the fineſt he ever ſaw.

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[m] *Id. ibid. Tom.* V. *p.* 129.

[n] *Id. ibid. Tom.* VI. *p:* 65.

[o] *Id. ibid Tom.* II. *p.* 359, *and Tom.* IV. *p.* 26.

[p] *Id. ibid. Tom.* V, *p.* 81.

With regard to the diſtance at which garden-beans ſhould be planted, Mr. Miller lays down as a general rule, that the larger beans ſhould be planted at a greater diſtance than the ſmall ones, and that thoſe which are firſt planted ſhould be put cloſeſt together, to allow for ſome miſcarrying. He therefore adviſes, where a ſingle row is planted, and that early, to put the beams two inches aſunder, and to allow thoſe of the third and fourth planting three inches; and when they are planted in rows a-croſs a bank, " the rows, ſays he[q]" " ſhould be two feet and an half aſunder: but the windſor-beans ſhould have a foot more ſpace between the rows, and the beans in the rows ſhould be planted five or ſix inches aſunder. This diſtance, continues he, may, by ſome perſons, be thought too great: but from many years experience, I can affirm, that the ſame ſpace of ground will produce a greater quantity of beans, when planted at this diſtance, than if double the quantity of ſeeds are put on it. In the management of theſe later crops of beans, the principal care ſhould be to keep them clear from weeds, and any other plants, which would draw away their nouriſhment; to keep earthing them up, and, when they are in bloſſom, to pinch off their tops, which, if ſuffered to grow, will draw the nouriſhment from the lower bloſſoms, which will prevent the pods from ſetting, and ſo only the upper parts of the ſtems will be fruitful: and another thing ſhould be obſerved in planting of the ſucceeding crops, which is, to make choice of moiſt ſtrong land for the later crops; for if they are planted on dry ground, they rarely come to much. —— In warm dry light land, all the late crops of beans are generally attacked by the black inſects, which cover all the upper part of their ſtems, and ſoon cauſe them to decay.

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[q] *Gardener's Dict.* Art. FABA.

" Horſe-beans delight in a ſtrong moiſt ſoil, and an open expoſure; for they never thrive well on dry warm land, or in ſmall incloſures, where they are very ſubject to blight, and are frequently attacked by a black inſect, which farmers call the black dolphin. Theſe inſects are often in ſuch quantities, as to cover the ſtems of the beans entirely, eſpecially all the upper part of them, and whenever this happens, the beans ſeldom come to good: but in open fields, where the ſoil is ſtrong, this rarely happens.

" Theſe beans are uſually ſown on land which is freſh broken up, becauſe they are of uſe to break and pulverize the ground, as alſo to deſtroy weeds; ſo that the land is rendered much better for corn, after a crop of beans, than it would have been before, eſpecially if they are ſown and managed according to the new huſbandry, with a drill-plough, and the horſe-hoe: for the ſtirring of the ground between the rows of beans will prevent the growth of weeds, and pulverize the earth, whereby a much greater crop of beans may, with more certainty be expected, and the land will be better prepared for whatever crop it is deſigned for after.

"The ſeaſon for ſowing of beans is from the middle of February to the end of March, according to the nature of the ſoil: the ſtrongeſt and wet land ſhould always be laſt ſown. The uſual quantity of beans ſown on an acre of land, is about three buſhels: but this is double the quantity which need be ſown, eſpecially according to the new huſbandry."

As neither M. Duhamel, nor his correſpondents, are very particular in relation to the culture of this uſeful plant, I here beg leave to add Mr. Miller's directions for the management of beans according to the new husbandry.

"The ground, ſays this experienced Gardener[r], ſhould be four times plowed before the beans are ſet; for that will break the clods, and render it much better for planting. Then, with a drill-plough, to which a hopper is fixed for ſetting of the beans, the drills ſhould be made at three feet aſunder, and the ſpring of the hopper ſet ſo as to ſcatter the beans at three inches diſtance in the drills. By this method, leſs than one buſhel of ſeed will plant an acre of land. When the beans are up, if the ground is ſtirred between the rows with a horſe-plough, it will deſtroy all the young weeds; and when the beans are advanced about three or four inches high, the ground ſhould be again plowed between the rows, and the earth laid up to the beans: and if a third plowing, at about five or ſix weeks after, is given, the ground will be kept clean from weeds, and the beans will ſtalk out, and produce a much greater crop than in the common way.

"When the beans are ripe, they are reaped with a hook, as is uſually practiſed for peas; and after having lain a few days on the ground, they are turned, and this muſt be repeated ſevera times, until they are dry enough to ſtack: but the beſt method is to tie them in ſmall bundles, and ſet them upright; for then they will not be in ſo much danger of ſuffering by wet, as when they lie on the ground; and they will be more handy to carry and ſtack, than if they are low. The common produce is from twenty to twenty-five buſhels on an acre of land.

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[r] *Ubi ſupra.*

"Beans ſhould lie in the mow to ſweat, before they are threſhed out: for as the haulm is very large and ſucculent, ſo it is very apt to give and grow moiſt: but there is no danger of the beans receiving damage if they are ſtacked tolerably dry, becauſe the pods will preſerve them from injury; and they will be much eaſier to threſh after they have ſweat in the mow, than before; and after they have once ſweated, and are dry again, they never after give.

"By the new huſbandry, the produce has exceeded the old by more than ten buſhels on an acre: and if the beans which are cultivated in the common method are obſerved, it will be found that more than half their ſtems have no beans on them; for by ſtanding cloſe, they are drawn up very tall, ſo that the tops of the ſtalks only produce, and all the lower part is naked; whereas in the new method, they bear almoſt to the ground; and as the joints of the ſtems are ſhorter, ſo the beans grow cloſer together on the ſtalks."

C H A P. II.

OF THE DISTEMPERS OF CORN.

M. DUHAMEL has treated the very intereſting and intricate ſubject of the diſtempers of corn, and the means of guarding againſt them, in ſo much clearer and more maſterly a manner than has yet been attempted by any of our Engliſh writers, that I cannot do better than give here, chiefly, the ſubſtance of what he has ſummed up on this head in his *Elements of Agriculture*[a]. He begins with ſpeaking

S E C T. I.

Of the Diſtempers which render Corn black;

And obſerves on this occaſion, that we ought not to wonder at the miſtakes of many authors, who have not been ſufficiently explicit in theſe matters, or have frequently confounded, in particular, what is properly called the *Smut* of corn, with a diſtemper denoted by the name of ***burnt-grain*** *; "becauſe, 1, ſmutty corn and burnt corn are often found in the ſame field: 2, in the years in which corn is much infected with ſmut, there generally are many burnt-ears: ſo that theſe diſtempers commonly go together. 3, both theſe diſtempers attack ſeveral kinds of farinaceous grain. 4, In each of theſe diſtempers, the mealy ſubſtance is converted into a powder more or leſs black and offenſive to the ſmell. Theſe two diſtempers have, however their peculiar marks, by which they ought to be deſtinguiſhed. I ſhall therefore, ſays my guide in this chapter, ſpeak of them ſeparately.

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[a] *Tom.* I. *p.* 304, *and ſeq.*

* Which Mr. Liſle, making the proper diſtincton, calls *Uſtilago*, or *burnt-ear*. *Obſervations in Huſbandry, Vol.* I. *p.* 242.

ARTICLE I.

" *Of Smut.*

" Three things are to be obſerved here: 1, the deſcription of ſmut; 2, it's cauſes; and 3, the means of preventing it.

SECT. I.

" *Deſcription of Smut.*

" Ever ſince the year 1751, I have obſerved the following marks which diſtinguiſh the ſmut in corn.

" 1, This diſtemper deſtroys entirely the germe and ſubſtance of the grain.

" 2, It affects not only the ear, but alſo, in ſome degree, the whole plant, when it has made a great progreſs.

" 3, It very ſeldom happens but that when one ſtalk is ſmutty, all the ears of the other ſtalks from the ſame root are ſo too.

" 4, So early as in March or April, upon opening carefully the hood or blades which cover the ear, and examining the young ear, then not above the ſixth part of an inch in length, and almoſt cloſe to the roots, I found this embryo already black and attacked with this diſtemper. Perhaps it may not always ſeize the plants ſo early.

" 5, When the diſtempered ear comes out of it's coverings formed by the blades, it looks lank and meagre; the common and immediate coverings of the grains are in this caſe ſo very ſlight and thin, that the black powder is ſeen through them; and from this time nothing is found, in lieu of grain, but a black powder, which has a fetid ſmell, and no conſiſtency. As this powder, of which the conſtituent particles have but very little coheſion, and of which the coverings are deſtroyed, is eaſily blown off by wind, or waſhed away by rain; the huſbandman, in houſing theſe plants, houſes only ſkeletons of the ears. If any impreſſion of this powder remains, it is eaſily taken off by ſifting: but I have not experienced it to be contagious, like that of burnt-grain †.

" M. Tillet, who gained the prize propoſed by the Academy at Bourdeaux for *the beſt account of what renders black the mealy ſubſtance of grain*, has obſerved that theſe corrupted ears are often found to be vitiated even in the hood, though this laſt looks as green and perfect as if nothing ailed the corn within. The upper part of the ſtalk of a ſmutty plant is not, commonly, quite ſtrait, from within about half an inch below the ear. If ſuch a ſtalk is ſqueezed there, it ſcarcely yields at all to the preſſure. If it be cut aſunder at about a ſixth part or a quarter of an inch below the ear, it will be found to be almoſt entirely filled with pith, in ſuch manner that only a very ſmall opening can be perceived in the heart of this ſtalk, inſtead of the large pipe that is in healthy ſtems. M. Tillet concludes from hence, that the circulation of the juices is obſtructed in the upper part of the ſtalk of ſmutty plants.

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† The common opinion, particularly confirmed by M. Liſle, is, that the powder of the ſmut is even more contagious than that of the burnt-grain [b]

[b] *Obſervations in Huſbandry, Vol.* I. *p.* 248.

" Bearded wheat is as apt to be ſmutty, as that which is not bearded; but neither M. Tillet nor I have ever met with a ſmutty ear of rye.

SECT. II.

Of the cauſes of Smut.

" THE ſmuttineſs of corn cannot be owing to a want of fecundation, as many have hitherto miſtakenly imagined; ſince it affects and deſtroys the organs of both ſexes long before the time of that fecundation.

" It cannot be imputed to the ſettling of wet upon the ears, or to fogs, or to a violent impreſſion of the ſun; ſince we have ſeen the ears ſmutty long before they ceaſed to be covered with the blades, which continue green till the diſtemper has made a great progreſs.

" The ſame obſervations refute abſolutely the opinion of thoſe who ſuppoſe the cauſe of the ſmut to be in the grains, after they are formed, and before they are paſt their milky ſtate.

" The ſmut of corn has been alſo aſcribed to the moiſture of the earth: but we do not ſee more ſmutty plants in the loweſt, and conſequently wetteſt parts of a field, than in the higheſt and moſt dry. Beſides, why ſhould there be a ſingle ſmutty plant in the midſt of numbers of ſound ones? However, as it appears that corn is more frequently attacked with this diſtemper in wet years, than when the ſeaſons are dry; too much moiſture may perhaps, without being the immediate cauſe of the ſmut, favour its progreſs more than drought would do.

" Some naturaliſts have aſcribed this diſtemper to inſects. If I am not authoriſed abſolutely to deny this, I can at leaſt aſſert that, after having been of this opinion for ſome time, all my endeavours to eſtabliſh it by facts have proved ineffectual. Some obſervers have indeed ſhewn me different inſects in ſmutty grains; but as I found the very ſame kinds likewiſe in ſound ears, I believe, with M. Tillet, that they are not in any manner the cauſe of this diſtemper. We know that the corn-caterpillar devours the mealy ſubſtance of the grain: but it does not occaſion ſmut. Numbers of flies lay their eggs upon theſe ſeeds; and the worms and maggots which proceed from them, eat the ſeeds: but this does not occaſion any thing like ſmut. The Reverend Dr. Hales, to ſatisfy himſelf whether the ſmut of corn might not proceed from the ſeeds being bruiſed by the flail, took a number of grains of different ſizes, and bruiſed them with a hammer. They grew well, and bore ears which were not ſmutty. Thus his own experience convinced this ſkilful Philoſopher, that he had conceived a wrong idea of the cauſe of this diſtemper.

" Several cultivators have thought that pigeon's dung and that of ſheep render corn ſmutty: but this is a groundleſs notion. We have large pigeon-houſes, the dung of which is ſtrewed upon our wheat lands: the ſame is done with the dung of our ſheep, and we even fold our flocks upon thoſe lands: yet we do not find that theſe fields are more infected with ſmut than others. This allegation is therefore abſolutely deſtitute of proof.

" Wolfius was of opinion that the ſmut of corn proceeds from a monſtroſity of the embryo: but M. Aimen has refuted that ſuppoſition, by ſhewing that the male flowers of certain kinds of plants are attacked with this diſtemper: now the flowers have not any embryo.

" M. Aimen M. D. has very judiciouſly obſerved, that the ſmut of corn cannot derive its origin from a defect in the ſap; as all the parts of the plant, except the ear, look heatlhy, and there are plants whoſe roots are perennial, which appear vigorous, though their ſeeds are ſmutty every year. He is of opinion, that whatever weakens the plant is apt to bring on the ſmut, and inſtances, as a proof of this, that it is a frequent cuſtom in his country to cut rye as ſoon as it ſpindles, for food for their cattle; and that this rye generally produces other ears, which ſeldom contain any but diſtempered grain: to which he adds, that ſeed-corn which has been pricked or run through with a needle; or which is not thoroughly ripe, and that which produces lateral or ſecond ears, is ſubject to the ſmut.

" The ſame obſerver, who has made ſeveral careful reſearches into what is properly called the ſmut of corn, holds that this diſtemper proceeds from an ulcer which attacks firſt the parts that ſuſtain the ſeeds, and afterwards ſpreads to the reſt of the flower. But, ſome will ſay, what is the primary cauſe of that ulcer? In order to diſcover it, M. Aimen examined ſeveral grains of barley with a microſcope: ſome of them were bigger than others: ſome were very hard; and others yielded to the preſſure of his nail: ſome were of a deeper, and others of a lighter colour; ſome longer, and others rounder, than they ought to have been: their rind was ſometimes wrinkled in ſeveral places, whereas in its natnral ſtate it is ſmooth: and laſtly, he perceived upon ſome of them black ſpots, which, when examined with a magnifying glaſs, appeared to be covered with mould. Theſe grains were ſeparated carefully, according to their ſeveral conditions, and ſown apart, though in the ſame ground. All the mouldy grains produced ſmutty ears the ſhrivelled, the parched, and thoſe that were attacked by inſects, either did not grow at all, or did not produce any ſmut.

" He then ſingled out a parcel of ſound grains, ſowed them, and ſome time after took them up in order to examine them again with a magnifying glaſs. He found ſome of them mouldy, replanted them all, and obſerved that the mouldy grains produced ſmutty ears.

" M. Aimen, without pretending that this is the only cauſe of the ſmut of corn, concludes from theſe experiments, that *mouldineſs is a cauſe of this diſtemper*.

" It is very hard to conceive how mouldineſs can produce this diſtemper; for as ſoon as the ſeed has ſprouted and produced its plant, the whole ſubſtance of the grain is conſumed. Whether the hulls or coverings grow mouldy or not, ſeems to be a circumſtance quite immaterial to the plant, which ceaſes from that time to ſubſiſt on what the ſeed had ſupplied it with till then. We readily conceive that if this mouldineſs attacked the plant, it might either kill it or render it poor and weak: but we cannot imagine how this mouldineſs ſhould affect only the organs of fructification, and entirely deſtroy them, without doing any viſible injury to the other parts of the ſame plant, even though it be a perennial. However, M. Aimen relates facts; to account for which one might conjecture, ſuppoſing the increaſe of plants to be only an extenſion of the embryo, that the organs of fructification which exiſt in imperceptible miniature in the ſeed, were already affected by the mouldineſs before the grains were depoſited in the earth. But let us abide by well obſerved facts: it being of more importance to collect them, than to be in a hurry to explain them by conjectures hitherto attended with little probability.

SECT. III.

" *Means of preventing this Diſtemper.*

" M. Aimen is of opinion, that, to prevent this diſtemper, the fineſt and ripeſt corn ſhould be choſen for ſeed, that it ſhould be threſhed as ſoon as poſſible, and that it ſhould be limed immediately after, as well, ſays he, to keep it from growing mouldy, as to deſtroy the mould already formed, if any ſuch there be; adding, that every method he has tried to make corn ſo prepared grow mouldy, has been ineffectual, and that he has never known it produce ſmutty ears."

According to this principle, the preparations which have been experienced to be ſerviceable in the caſe of burnt-grain, and particularly M. Tillet's lye, which will be ſpoken of in the next article, may be equally beneficial to guard againſt ſmut. But we ſhall not attempt, continues M. Duhamel, to make any addition to M. Aimen's advice, becauſe we have not ſtudied the diſtemper properly called Smut, ſo much as we have that far more dangerous one which we diſtinguiſh by the name of burnt-grain. According to ſome experiments made by M. Tiller, the black powder of ſmutty corn does not appear to be contagious. However, we ſhould ſpeak more affirmatively on this point, if we had been able to collect a ſufficient quantity of that powder: but, as was ſaid before, the wind and rain carry it away, and but very little of it is found in granaries. We exhort thoſe who wiſh to contribute to the progreſs of agriculture, to make farther trials, in order to aſcertain

certain whether the ſmut of corn be really contagious or not: but at the ſame time we caution them to be careful not to confound this diſtemper with the *uſtilago*, or burnt-ear; for want of which diſtinction ſeveral philoſophers have hitherto been miſled.

As weak plants are moſt ſubject to ſmut, M. Aimen[c] recommends good tillage, as a ſure means of giving them ſtrength and vigour. It is probably for this reaſon that corn is very ſeldom ſmutty when managed according to the new huſbandry.

He obſerves, that all the lyes generally made uſe of, preſerve the plants from mouldineſs; and of all of them, lime ſeems to him the moſt effectual.

M. de Lignerolle ſays[d], that the ſureſt means of avoiding ſmut, and that which he has practiſed with ſucceſs ever ſince the year 1739, on upwards of three hundred acres of land, is, to change the ſeed every year, to be very careful that the ſeed-corn be well dried and thoroughly ripe, and that it be not ſmutty, nor have any ſmutty powder ſticking to it. He then pours boiling water on quick-lime, in a large tub; and after the ebullition is over, as much cold water as there was hot, and ſtirs it all ſtrongly together, in order to diſſolve and thoroughly mix the lime. The quantity of wheat intended to be ſowed is ſprinkled with this lye, and then well ſtirred with a ſhovel, and laid in as high a heap as poſſible. It is beſt to keep the grain for a week after this preparation, turning it every day; for otherwiſe it would heat ſo as to deſtroy the germe. By theſe means he has not had any ſmut, when the fields around him have been infected with that diſtemper.

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[c] DUHAMEL, *Culture des Terres*, *Tom.* IV. *c.* 2.
[d] *Id. ibid. Tom.* V. *p.* 177.

M. Donat, near Rochelle, thinking the ingredients commonly employed in ſteeps too dear for the uſe of farmers, ſtudied for ſome years to find out ſomething cheaper, eaſy to be had every where, and therefore better calculated to be of general uſe. "I have had," ſays he[e], in a letter to M. Duhamel, "the good fortune to accompliſh "what I wiſhed; for I now uſe only pigeon's-"dung, quick-lime, aſhes, and ſea-ſalt, where this "laſt can be conveniently had. I have ſometimes "made with theſe ingredients, ſteeped in water, "ſo ſtrong a liquor, that it has even deſtroyed "the germe of the grain. But there will be no "danger of that, if care is taken to obſerve the "following directions, which are the reſult of ſeven "years ſucceſsful experience, even at times when "farmers who have neglected to follow my ex-"ample, have had ſuch wretched crops as have "not paid the charge of reaping.

"Take quick-lime and pigeon's-dung, of each "twenty five pounds, forty pounds of wood-"aſhes, and twenty five pounds of ſea-ſalt, or "ſalt-petre. Put all theſe into a tub large enough "to hold half a hogſhead of common water "added to them. Stir them all well with a ſtick, "till the lime is quite diſſolved. This lye will "keep ſome time without ſpoiling. It muſt be "ſtirred again juſt before the corn is ſteeped in "it. The grain is then put into a baſket, and "plunged in the lye, where it remains till it "has thoroughly imbibed it; after which it is "taken out, and laid in a heap, till it is quite "drained of all it's moiſture: or, which is a ſtill "better way, take a maſhing-tub, fill it with "grain to within four inches of the brim, and "then pour in the lye well ſtirred beforehand.

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[e] Ibid. p. 185.

“ When the tub is full, let the lye run out at “ at the bottom, into ſome other veſſel, in order “ to uſe it again for more corn. Let the grain be “ then taken out and laid in a heap to drain; and “ continue in this manner to ſteep all your ſeed- “ corn. The wheat thus prepared may be ſowed “ the next day, and muſt not be kept above five “ or ſix days, for fear of it's heating. This I ſay “ from experience. The quantity of lye above “ preſcribed, will ſerve to prepare twenty buſhels “ of wheat *.

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* Mr. Tull obſerves[f], that brining, and changing the ſeed, are the general remedies for ſmut. The former of theſe, he had heard, was diſcovered about ſeventy years before he wrote, by the ſowing of ſome wheat which had been ſunk in the ſea, and which produced clean corn, when it was a remarkable year for ſmut all over England:—but he afterwards doubts whether this might not happen by it's being foreign ſeed, and therefore a proper change for our ſoil. He tells us that two farmers, whoſe lands lay intermixed, uſed ſeed of the ſame growth, from a good change of land, and that the one, who brined his ſeed, had not any ſmut, whilſt the other, who neglected that precaution, had a very ſmutty crop.—But again he doubts whether this ſeed might not have been changed the year before, and ſo might not be greatly infected; or at leaſt not more than the brine and lime might cure. He adds, that ſmutty ſeed-wheat, though brined, will produce a ſmutty crop, unleſs the year prove very favourable; for that favourable years will cure the ſmut, as unkind ones will cauſe it: but above all, he aſſures us, that the drill-huſbandry is the moſt effectual cure.

Count Ginanni, a patrician of Ravenna, who has favoured the world with a very accurate and ingenious treatiſe on the diſtempers of corn in the blade, deems the ruſt incurable, after it has once taken place[d]. He has prevented it by ſprinkling the plants, before their ears were formed in their hoods, with a ſolution of ſal ammoniac or ſalt-petre in water mixed with ſalt of tartar, and with other alkaline ſubſtances; but obſerves, that ſuch preparations are too dear for the uſe of farmers. He thinks, that ſowing thin and keeping the corn quite free from weeds, will generally be a good preſervative, as he himſelf has frequently experienced.

[f] *Horſe-hoeing Huſbandry, c.* 10.

[d] *Delle Malattie del Grano in Erba, Trattato Storico-fiſico,* p. 373.

ARTICLE II.

Of Burnt-grain [f].

" Almoſt all the writers upon huſbandry have confounded this diſtemper of corn, with that which is properly called Smut; though it is, in fact, very different, and much more dangerous. *Smut*, properly ſo called, occaſions a total loſs of the infected ears; but as the black powder which it produces is very fine, and the grains of that powder do not adhere together, wind and rain carry them away, ſo that the huſbandman houſes little more than the ſtraw, which does not infect the ſound grains, and ſcarcely damages their flour. The *burnt* or *carious grains* are, on the contrary, often houſed with the ſound grain, which they infect with a contagious diſtemper, at the ſame time that they render it's flour brown, and give it a bad ſmell.

SECT. I.

" *Characters of* Burnt-grain.

" The following are the characters of this diſtemper, which the Romans called *Uſtilago*, and the French name *Charbon*.

" 1. The plants which are to produce burnt-ears are ſtrong and vigorous.

" 2. The ears attacked with this diſtemper are not, at firſt, readily diſtinguiſhed from thoſe which are ſound; but after their bloſſoming is paſt, they become of a deep bluiſh green, and then turn whitiſh, at which time they are eaſily known. This diſtemper is generally thought to be occaſioned by a ſudden intenſe heat of the ſun, or by a fog which has preceded that extraordinary heat.

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[f] *Elements d' Agriculture, Tom.* I. *p.* 314.

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" 3. Though all the ears which proceed from the ſame ſeed are uſually attacked with this diſtemper, yet M. Tillet, M. Aimen, and myſelf, have found ſound ears on the ſame plant with the infected: we have even met with ſome ears of which part of the grains were ſound, and the reſt diſtempered; and we have likewiſe ſeen grains of which one part contained white flour, and the other this carious burnt powder*.

" 4. The huſks or outer coverings of the grains in burnt ears are almoſt always pretty ſound; with this difference only, that when the ears begin to ripen, they look drier and more parched than thoſe of the ſound ears.

" 5. The ſkin, or bran which forms the immediate covering of the grain itſelf is not deſtroyed here, as it is by the diſtemper properly called ſmut. This covering ſtill retains conſiſtency enough to preſerve the grain in nearly its natural ſhape, and to make it look whitiſh.

" 6. The burnt grains are ſhorter, rounder, and lighter than the ſound grains, and likewiſe ſometimes larger, and ſometimes ſmaller. The furrow which runs lengthwiſe of the grains of wheat is ſometimes totally effaced, and ſometimes it remains entire: the piſtils at the end of the grains are dried and withered.

" 7. The germe is not perceived at the lower end of the burnt grains.

" 8. Till the time of bloſſoming, there is but little difference between the burnt grains and the ſound: only the former are ſomewhat more ſwelled. But at, or during the time of bloſſoming, the diſtempered ears turn bluiſh; their huſks are more or leſs ſpeckled with ſmall white ſpots; their grains, bigger than in their natural ſtate, are likewiſe of a deeper green; and ſo long as they preſerve this colour, they ſtick very cloſe to the bottom of their cheſts. This diſtemper frequently attacks the ears of corn while they are yet very young, and cloſely ſhut up in their hoods. Then the membranes which adhere to the ſides of the grain fade and languiſh; the embryo becomes here and there of that deep green colour which was mentioned before; the infected ears have not the ſame conſiſtency as the ſound ones; and their huſks become dry and whitiſh, in proportion to the increaſe of the diſtemper.

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* Count Ginanni has made the ſame remarks.

" 9. The grains retain a ſmall degree of firmneſs. If opened, as may eaſily be done with one's nail, they are found to be full of a ſubſtance which feels unctuous, is of a brown colour, bordering upon black, and of a nauſeous ſmell. It is not a light powder, like that in ſmutty ears; on the contrary, the powder of burnt grains has ſome coheſion; and, when viewed through a microſcope, the particles of this powder appear larger than thoſe of the ſmut.

" 10. Somewhat before the time of flowering, the grains ſeem full of a white ſubſtance, which begins to turn brown firſt next the ſtem, and this colour ſpreads afterwards by degrees over the whole ear: then the grains look as if they were ſeparated into equal parts, by furrows; but theſe furrows diſappear as the bulk of the grain increaſes.

" 11. What has been ſaid ſhews that the grains are more damaged by ſmut, than by this diſtemper.

" 12. It is evident that the grains which are much infected with the diſtemper here diſtinguiſhed by the name of burnt-grain are incapable of growing. But I have ſowed ſound grains picked out of ears of which the greateſt part was burnt.

"13. Theſe grains, ſown in part of a kitchen-garden, have produced very ſtrong plants; and though my experiment was interrupted by the depredations of birds, there ſeemed to me to be ſome ſound ears amongſt a great number of burnt ones.

"13. Some of the burnt grains are cruſhed by the flail, in threſhing: their black powder is ſpread upon the other grains which are ſound; this greaſy powder ſticks chiefly to the hairs at the end of the grain oppoſite to the germe, and there forms a black ſpot, on account of which thoſe grains are called *ſpotted*, *ſpeckled*, or *black at the point*. Many grains which eſcape the flail remain entire, by reaſon of their lightneſs. Some of theſe are ſeparated by throwing the corn round with a ſhovel, and many more by good winnowing. But this ſpot at the end remains, as will alſo ſeveral of the burnt grains; and theſe will be ſufficient to diſcolour the flour of the whole heap, by rendering it brown, and to give it a diſagreeable taſte.

"14. To prevent this inconvenience, and that the bread made of this corn may be the better, theſe grains are cleaned in tin ſieves made like a drum: they are afterwards waſhed; and all the grains which ſwim on the ſurface of the water, and which generally are burnt grains, are taken off with a ſkimmer. The water waſhes off the black ſpot, which is only ſuperficial, as is plain from it's being inſtantly removed if the grain is rubbed with a cloth.

SECT. II.

"*Of the cauſe of* Burnt-grain.

"The cauſe of this diſtemper is, I confeſs, hitherto as little known to me as that of ſmut.

Some have imputed it to dung; others to fogs; others, to a ſudden extraordinary heat of the ſun; others, to inſects; others, to the moiſture of the ſoil; and others again, to a want of due maturity in the ſeed: but as theſe various opinions are refuted by good obſervations and well made experiments, we refer to what was ſaid before concerning the ſmut of corn.

"Would one think it likely, that a powder which is only ſuperficial, and which touches only the outer ſkin of the grain, without penetrating to it's inſide, ſhould be ſo very contagious as to communicate a diſtemper to every grain impregnated by it? But what is ſtill more extraordinary, is that this powder damages only the organs of fructification. As improbable as this may ſeem to be, ſeveral experiments made by M. Tillet leave no room to doubt the truth of the fact. They demonſtrate that farmers are perfectly right in carefully avoiding to ſow ſpotted grains. As a particular detail of all the experiments which M. Tillet has publiſhed in his memoirs on this ſubject would ſwell the preſent article too much, I ſhall give only their reſults, and the inferences which that accurate obſerver has drawn from them.

"Several authors having looked upon various kinds of dung as the immediate cauſe of this diſtemper, and others having maintained that it is hereditary; all M. Tillet's experiments have been calculated to clear up theſe two opinions: and at the ſame time he has endeavoured, by thoſe experiments, to find out the means of preventing this dreadful diſtemper.

"1. Dung, of every kind, did not occaſion any perceptible difference. The infected ſeeds which he ſowed, and from which the black corn was to grow, produced as many diſtempered plants in the beds which were not dunged, as in thoſe that were. He has not obſerved that any kind of dung favours or prevents the progreſs of this diſtemper.

" 2. Dung made of ſtraw which had borne burnt ears did not ſeem to communicate this diſtemper; but ſtraw infected therewith, and not rotted, did ſeem to produce it. The injury was ſtill more perceptible, when the powder of the burnt ears was mixed with the earth.

" 3. All the grains naturally ſpotted, whether they had been gathered from off the ſame ground, or brought from a conſiderable diſtance, either of bearded or ſmooth wheat, or of ſpring-corn, produced very many burnt ears.

" 4. Choſen wheat, taken grain by grain out of picked ears, in order to be the more certain that there were not any diſtemper'd grains among it, being ſown, ſome in dunged and ſome in undunged land, without having been prepared, produced at moſt but very little, and ſometimes not any, black grain.

" 5. Sound grains choſen in the ſame manner, and afterwards ſprinkled with the powder of burnt grains, produced as many black ears as grain naturally ſpotted.

" 6. Choſen grains, free from black, after being ſteeped in a lye made with lime and ſea-ſalt, produced fewer diſtempered ears than other ſimilar grains ſowed without this preparation.

" 7. There were ſtill fewer diſtempered ears in the beds where the ſeed had been prepared with quick-lime and ſalt-petre.

" 8. The circumſtance of ſowing late or early never ſeemed to be of any conſequence in theſe trials.

" 9. It appears from M. Tillet's experiments, which he repeated ſeveral times, that the powder of the burnt-ears is contagious, ſince ſound grain ſmeared with it, or ſown in furrows where it had been ſtrewed, produced a great quantity of diſtempered ears. The ſame gentleman experienced likewiſe, that this contagious powder does not loſe it's bad quality by being expoſed to a heat even of ſixty degrees of Réaumur's thermometer, which is equal to 142 degrees of Farenheit's: but that it muſt be quite burnt before it will ceaſe to infect other grain; for that, otherwiſe, it retains it's noxious quality for years, as ſtrongly as at firſt.

" 10. M. Tillet's experiments prove, that thoſe farmers who waſh the ſacks into which their ſeed-corn is to be put, do very right; for that if thoſe ſacks were daubed with this powder, they would infallibly infect part of the ſound grain put into them. For the ſame reaſon he adviſes the ſeedſman to be very careful that none of this black powder be upon his baſket or hand when he ſows.

" 11. M. Tillet thinks he has likewiſe remarked, that the plants of wheat which are attacked with this diſtemper are more eaſily affected by froſt, than thoſe which are ſound. If ſo, hard froſts muſt be of great ſervice in this caſe, becauſe, at the ſame time that they deſtroy thoſe diſtempered plants, they will enable the earth to afford the more nouriſhment to the ſound ones, and the crops, when reaped, will be free from theſe infected ears, which do them ſo much injury.

" 12. The black powder, ſo contagious to wheat, does not affect rye, or four-row'd barley, or bigg; but the powder of the ſeeds of cockle or darnel is pernicious to wheat.

" 13. Smyrna wheat is leſs ſuſceptible of this diſtemper than any other grain: but ſpring-wheat is very apt to be greatly damaged by it.

SECT.

§. III.

" *Means of preventing this diſtemper.*

" It is muſt be allowed that the knowledge which has been acquired of the cauſe of the diſtemper called *burnt* or *carious* grain, has put accurate obſervers in the way of finding out a proper remedy: for, ſince the powder of theſe infected grains ſpreads its contagion to ſuch others as are impregnated therewith, it is probable that every means of removing this powder may be effectual, provided the venom has not, from the very firſt contact, affected the inſide of the grain intended to be ſown. If it has not, thorough cleanſing in proper ſieves, and waſhing with fair water, ſuch as are practiſed in ſeveral places to cleanſe ſpotted corn, might be propoſed as effectual remedies; as might alſo the lime water, and the ſtrong brine which ſeveral farmers uſe, and the ſolution of arſenic, of which ſome people have pretended to make a great ſecret. All theſe preparations ought to be of ſervice, and, according to M. Tillet's experiments, they are ſo in fact: but at the ſame time, they frequently are not ſufficient. This ſubject ſtood therefore in need of being cleared up by judicious and accurate experiments made purpoſely with this view. M. Tillet has zealouſly undertaken the taſk, and the following concluſions may be drawn from his diſcoveries.

" 1. The defect which the black powder communicates to ſeeds is only ſuperficial, and does not affect the internal organs of the grain before it is put into the earth.

" 2. Therefore, whatever contributes to remove this powder from off the ſurface of the grain, will greatly conduce to preſerve corn from this diſtemper.

" 3. Grain perfectly free from all infection of this burnt, carious, or rotten grain, will not produce plants attacked with this diſtemper.

" 4. Grain blackened with this contagious powder, may be rendered ſound, by clearing it entirely of this powder.

" 5. The action of ſifting, and the precaution of waſhing the grain in ſeveral waters, leſſen, indeed, the effects of the contagion, but they are not ſufficient to cure it; for a great many burnt ears have been found among corn of which the ſeed had been waſhed in ſeveral waters.

" 6. Lime, though more efficacious than plain water, is not always ſufficient. I muſt obſerve here, that the manner of liming corn was formerly different from what is practiſed now. The corn was then put into baſkets, which were plunged into hot lime-water: it was ſtirred well in thoſe baſkets, and all the grains that ſwam upon the water were carefully ſkimmed off. By this means all the diſtempered grains were ſeparated from the ſound; and theſe laſt were cleanſed much better than they can be by the preſent method of ſimply pouring lime-water upon a heap of grain, and then ſtirring it with ſhovels; or by only mixing the grain with lime ſlaked in the air, and reduced to powder.

" One of our farmers, a careful man, who reflected on what he did, being obliged, one year, to ſow his land with ſpotted wheat, waſhed his ſeed-corn in lime-water, by immerſion, in the manner I have juſt related, and had not any black grain the next year.

" Several experiments, made by M. de Gouffreville, in the diſtrict of Caux in Normandy, which have been printed, prove likewiſe ſtrongly the good effects of lime uſed in the manner before-mentioned: and what confirms ſtill more the advantage ariſing from this practice, is that whenever our farmers ſow corn that has not been limed, their fields are exceſſively infected with black ears.

" 7. Waſhing the ſpotted grain in ſeveral waters is a good precaution; but it muſt afterwards be ſteeped in brine till it is thoroughly impregnated therewith, and then be ſtrewed with powdered lime.

" 8. A ſtrong brine of ſea-ſalt is good, and may be uſed to great advantage where ſalt is cheap.

" 9. One part of ſalt-petre in nine parts of water will act ſtill more powerfully than ſea-ſalt, and ſhould therefore be uſed in places where the farmer can conveniently procure it.

" 10. Strong alkaline lyes are yet better. Potaſh, ſalt of tar, a lye made of any vegetable aſhes abounding in ſalt, urine of men or cattle become alkaline by putrefaction, &c. Of theſe the eaſieſt to be come at in every place may be choſen to make a lye for ſeed-corn. The aſhes of ſea-weeds are found to be very ſerviceable, where they can be had cheap. Theſe aſhes, rejected by dyers and others who uſe lyes, becauſe they have too much ſea-ſalt in them, may, for that very reaſon, be employed to the greater advantage for the preparation of corn.

" 11. As it has been found that grain choſen with care, or free from black, produced but few diſtempered ears, we may reaſonably conclude, that the farmer will do well in changing his ſpotted corn, whenever he has any ſuch, for ſound ſeed of the growth of other land.

" 12. The reſult of M. Tillet's obſervations may be reduced to this. If the ſeed is ſpotted, it muſt, in the firſt place, be waſhed ſeveral times in fair water, till the black is entirely taken off; and then it ſhould be ſteeped in a lye. If it is not ſpotted, it need only be ſteeped in the following liquor.

"Make, in a tub, a lye as for waſhing of linnen, by putting four pounds of water to every pound of aſhes. 100 pounds of aſhes and 50 gallons of water, will yield 35 gallons of lye, to which ſhould be added 15 pounds of quick-lime. This will be ſufficient to prepare twenty buſhels of wheat. When this lye is to be uſed, it ſhould be heated to ſuch a degree that a man can but juſt bear to hold his hand in it; the corn ſhould then be plunged into this liquor, in baſkets, and be well ſtirred with a flat ſtick, like the broad end of an oar; the baſkets ſhould afterwards be lifted up, and ſuſpended by poles, over the tub, that the lye may drain off into it; and laſtly, the ſeed thus prepared ſhould be ſpread upon the floor of the granary, till it be dry enough for ſowing. If it is prepared before-hand, it muſt be ſtirred and turned from time to time with a ſhovel, to prevent it's heating. With this precaution, the ſeed thus prepared may be kept a month, or even a whole year.

"We ſteeped ſome wheat in this lye at Mr. Taponat's, near la Rochefoucault, in 1760, and had the pleaſure of ſeeing in 1761, that the corn produced by this ſeed, was perfectly free from black, whilſt a quarter part, a third, nay even half of the crops in the neighbouring fields were attackd with it.

"M. Delu boiled two pounds of ſalt of tartar in a quantity of water ſufficient to ſteep an hundred pounds of wheat, which he put into it while the lye was warm, and afterwards ſprinkled it with quick-lime. The grain was ſowed on the 11th of October 1755, in part of a field of three acres. The reſt of the field was ſowed with ſome of the ſame wheat, ſteeped only in lime-water. No difference appeared in the plants of theſe grains, during their growth; but ſome days before they were reaped, M. Delu, with an experienced farmer, examined them very carefully, and found a conſiderable quantity of burnt-grain in the part ſowed with the wheat which had been ſteeped in the lime-water; but much leſs in the other part where the grain ſteeped in the lye was ſowed. This confirms M. Tillet's experiments[e].

" All the trials that have been made, prove that ſharp, or acrid ſubſtances are the fitteſt to prevent the black in corn[f]; I therefore think that all ſteeps of this kind muſt be ſerviceable; and indeed I ſee not why one ſhould not uſe the lye in which linnen has been waſhed, after ſtrengthening it with a little freſh aſhes, and doubling the proportion of lime. I have experienced that this lye is very ſharp; but I have not been able to aſcertain it's efficacy with reſpect to the preſerving of corn, either from this diſtemper or from ſmut, becauſe we have not had any black in our fields for ſeveral years paſt*.

" 13. Several farmers, in different provinces, have uſed a ſolution of arſenic for the preparation of their ſeed-corn. Great and juſt complaints have been made of the accidents occaſioned thereby; and, among others, an eminent phyſician in France has publiſhed a diſſertation tending to ſhew the neceſſity of forbidding the uſe of that poiſonous liquor. He therein relates numbers of accidents which, to his knowledge, had befallen the ſeedſmen and others concerned in the making and uſing of this preparation. But now that M. Tillet has furniſhed the world with ſimpler, leſs expenſive, and very effectual means of cleanſing ſpotted corn, without at all endangering the health of any one, it is to be hoped that none will hereafter uſe that pernicious drug, ſo capable of occaſioning the moſt dreadful accidents, if any of it ſhould, inadvertently, chance to be mixed with the corn ground into flour, or if the bad grain ſkimmed from off this ſteep ſhould happen to be given to poultry or cattle: beſides, the ſeeds thus poiſoned, as it were, cannot but deſtroy all the partridges, pidgeons, &c. that pick them up.

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[e] Duhamel, *Culture des Terres, Tom.* V. *p.* 210.

[f] *Elements d'Agriculture, Tom.* 1. *p.* 330.

* Count Ginanni ſays, he has found benefit from ſteeping the ſeed corn in lime water; but, that it has not always been effectual. He has experienced, that ſprinkling the ſeed corn with flower of brimſtone, ſtirring, and mixing them well together, is of great ſervice to prevent this diſtemper, which, he is confident, may likewiſe be guarded againſt, in a very great meaſure, by deep, good, and frequent plowing, ſo as to bring the ground to, and keep it in fine tilth: adding, that farmers ſhould be as careful as poſſible, to pluck up every plant affected with this diſtemper, the moment they ſee them. *p.* 375.

" As men generally love to ſtart objections, ſome may perhaps ſay, that if this diſtemper is ſo contagious as has been here repreſented, it would make ſuch progreſs from year to year, that we ſhould at laſt reap nothing but burnt grain. But that is not to be feared; for frequently a year in which this diſtemper has prevailed much, is followed by another in which ſcarce any of it is ſeen. Hardly any burnt ears were found in the crops of 1754, 1760, and 1761. But I think I find another anſwer to this objection, which has undoubtedly it's weight, in M. Tillet's obſervations. It is, that as hard froſts certainly kill moſt, if not all, of the plants which are infected with this diſtemper, it's progreſs is thereby happily ſtopt.

" It may again perhaps, be aſked; how this burnt grain came firſt to be introduced in a country where it never was before, if the ſpreading of it be occaſioned only by it's contagious powder? It will readily be granted that this diſtemper may be produced by other cauſes, beſides it's black powder: but M. Tillet's experiments prove inconteſtibly, that this powder is contagious; and his reſearches furniſh us with means, if not of totally extirpating the diſtemper, at leaſt of diminiſhing it conſiderably. We therefore ſhall reap from them the advantage of having more plentiful harveſts, better bread, and corn fitter to keep.

A R T. III.

Of the Spur, *which the French call* Ergot [g].

“THOUGH what I have ſaid hitherto relates to the culture of wheat, the ſame principles may be applied to other ſorts of grain. I ſhall now ſpeak of a diſtemper which frequently attacks rye, and ſometimes does damage likewiſe to wheat. The following remarks will give an idea of it.

“1. The grains which have the ſpur are thicker and longer than the ſound ones, and generally project beyond their huſks, appearing ſometimes ſtrait and ſometimes more or leſs crooked.

“Their outſides are brown or black; their ſurface is rough; and one may frequently perceive in them three furrows, which run from end to end. Their outward end is always thicker than that which ſticks to the chaff, and that moſt ſwollen end is ſometimes ſplit into two or three parts. It is not unuſual to find on their ſurface cavities which ſeem to have been made by inſects.

“3. When a ſpurred grain is broken, one perceives in the middle or centre of it a pretty white flour, covered with another flour which is rediſh or brown. Though this vitiated flour has ſome conſiſtency, it may nevertheleſs be crumbled between one's fingers. M. Aimen has indeed ſometimes found this powder almoſt as black as that of ſmutty wheat.

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[g] *Id. ibid.* p. 333.

" 4. Theſe grains, when put into water, ſwim at firſt, and afterwards ſink to the bottom. If chewed, they leave a bitter reliſh on the tongue.

" 5. The chaff appears ſound, though what is outmoſt is ſomewhat browner than when the ears are ſound.

" 6. All the grains of the ſame ear are not ever attacked with the ſpur.

" 7. The grains which have this diſtemper ſtick leſs to the ſtalks than ſound grains do.

" 8. M. Aimen imputes this diſtemper to the grains not being impregnated; and aſſures us that he has not ever found a germe in grains which had the ſpur. The ſame obſerver has collected, in a memoir which he has ſent me, ſeveral reflections and microſcopical obſervations; but I paſs over in ſilence ſuch reſearches as are more curious than uſeful.

" 9. I ſhall not ſtop to refute the opinion of thoſe who have pretended that fogs, dews, rain, the moiſture of the earth, may give this diſtemper to rye. But I cannot help ſaying that M. Tillet thinks, as does alſo M. Aimen, that other plants, beſides rye, are ſubject to the ſpur. M. Tillet has ſeen, and M. Delu has ſhewn me, grains of wheat which had the ſpur. The ſpur ought therefore not to be confounded with the *uſtilago* or burnt grain: they are two different diſtempers: and what ſeems ſtill more to eſtabliſh this difference, is, that M. Tillet's experiments prove that the powder of the ſpurred grains is not contagious like that of the carious or burnt.

" M. Tillet is ſtrongly inclined to think that the ſpur is occaſioned by the ſting or bite of an inſect

ſect, which turns the rye into a kind of gall; and he ſuſpects a ſmall caterpillar of being the cauſe of this miſchief. But neither he nor I dare to ſpeak affirmatively on this point.

" Dodard, Langius, Fagon, Delahire, Noel, and, lately, M. Salerne, give particular accounts of the diſeaſes with which numbers of people have been ſeized in ſome years, owing to their having lived upon bread in which there was much rye affected with this diſtemper.

" As moſt of the diſtempered grains are much bigger than the ſound ones, it is eaſy to ſeparate the greateſt part of them by ſifting. It is what the peaſants of Sologne do, when corn is not dear; but in times of great ſcarcity or dearth, they are loth to loſe ſo much grain: and then it is that they are attacked with a dry gangrene, which mortifies the extreme parts of the body, ſo that they fall off, almoſt without cauſing any pain, and without any hemorrhagy. The Hotel-Dieu at Orleans had had many of theſe miſerable objects, who had not any thing more remaining than the bare trunk of the body, and yet lived in that condition ſeveral days*.

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* " The effects of this diſtempered or *cornuted* rye," ſay the Philoſophical Tranſactions [c], " are, to dry up the milk in women; to cauſe ſometimes malignant fevers accompanied with drowſineſs and raving; to breed the gangrene in arms, but moſt in legs, which ordinarily are corrupted firſt. This corruption is preceded by a certain ſtupefaction in the legs, upon which follows a little pain, and ſome ſwelling without inflammation, and the ſkin becomes cold and livid. The gangrene begins at the centre of the part, and appears not at the ſkin till a long while after; ſo that people are often obliged to open the ſkin, and find only the gangrene lurking under it. The only remedy for this gangrene is to cut off the part affected: for if it be not cut off, it becomes dry and ſhrivelled, as if the ſkin were glued over the bones, and 'tis of a dreadful blackneſs without rottenneſs. Whilſt the legs are drying up, the gangrene aſcends to the ſhoulders, and one knows not which way it communicates itſelf.—Poor people are almoſt the only perſons ſubject to theſe evils."

[c] *Lowthorp's Abridgment*, Vol. II. p. 626.

"As it is not in every year that the ſpur in rye produces theſe dreadful accidents, Langius is of opinion that there may be two kinds of this diſtemper; one which is not hurtful, and the other which occaſions the gangrene we have been ſpeaking of. It is however probable that there is but one kind of ſpur, and that it does no hurt, firſt, when ſufficient care is taken in ſifting the grain; and, ſecondly, when only a ſmall part of the corn is diſtempered. It is alſo ſaid, that the ſpur loſes it's bad quality after the grain has been kept a certain time: in which caſe, the reaſon why ſome peaſants are attacked with the gangrene in years of dearth may be, that they conſume their crop as ſoon as the harveſt is over."

After thus treating of the principal diſtempers which render the ears and grain of corn either quite black, or at leaſt of a dark colour; M. Duhamel proceeds to the following

SECT. II.

Obſervations on the other Diſtempers of Corn;

In which he is much more particular than any Engliſh writer has yet been; diſtinguiſhing by the appellation of *ruſt*, *empty-ears*, *ſhrivelled grain*, *parched grain*, *glazed grain*, *abortive corn*, and *barren ears*, the ſeveral accidents which we commonly rank under the general names of *mildew* and *blight*, and adding thereto ſome very appoſite reflections on the *bending* or *lodging* of corn, which he likewiſe looks upon as a diſtemper. Under

ART.

A R T. I.

Of *Mildew,* which the French call *rouïlle* (*ruſt*) M. Duhamel ſays[b]:

"THIS diſtemper attacks the blades and ſtems of corn, which it covers with a powder of the colour of ruſt of iron, when at the height of their vegetation. This ſubſtance does not adhere ſtrongly to the blades; for I have ſeen the hair of white ſpaniels full of this powder after they have run through a field attacked with this diſeaſe. It is likewiſe known, that if the infected wheat is waſhed by a plentiful rain, the *ruſt* diſappears almoſt entirely, and the grain ſuffers little from it. The French give it the name of *ruſt*, from the colour of the powder; and it ſeems to be the ſame diſtemper which the Roman writers call *rubigo*.

"The cauſe of this diſtemper is uſually imputed to dry gloomy weather happening while the corn is at the height of it's vegetation: and in effect, I have many times obſerved, that when a hot ſun has ſucceeded ſuch dry hazy weather, the corn was *ruſted* within a few days after.

"This diſtemper is not common in clear and dry hot years: but when the ſpring is wet, the fineſt fields of wheat run great hazard of being deſtroyed by the mildew, which generally appears upon the breaking out of the ſun in the morning, after cloſe and ſultry weather, during which there has not been any dew. The ruſty powder then gathers upon the blades in ſuch quantities as to cover the earth two feet around. M. de Chateauvieux cut off the mildewed blades, and found the trial anſwer: the ſame plants produced new blades, and throve much better than thoſe on which this operation had not been performed: but this cannot be done except when the corn is very young.

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[b] *Elements d'Agriculture, Tom.* I. p. 338 & *ſeq.*

" This diſtemper is very fatal: for the fineſt wheat is ſuddenly brought almoſt to nothing, when it is entirely attacked with it.

" If it attacks the plants while they are young, and before their ſtems begin to riſe, the miſchief is ſometimes not very great, provided there comes on a ſeaſon favourable to their farther growth. In this caſe, they are only weakened, as if they had been fed or mowed. They ſhoot out anew, and produce ears: though their ſtraw is ſhorter, and thoſe ears are ſmaller, than they would otherwiſe have been. But if both blades and ſtalks are mildewed at the ſame time, the farther growth of the plant is ſtopt, and the grain gets ſcarce any more nouriſhment; ſo that the crop is exceedingly diminiſhed.

" This grievous diſtemper well deſerves the ſerious attention of every inquirer into nature, who intereſts himſelf in the progreſs of agriculture; and I cannot too ſtrongly exhort all ſuch, to endeavour to inveſtigate it's cauſes and remedies.

" Several authors have, very improperly, confounded this diſtemper with others to which corn is ſubject. M. Tillet imputes it to a ſharpneſs in the air in dry cloudy weather, which breaks the veſſels interwoven with the ſubſtance of the blades and ſtem, and makes them diſcharge a thick oily juice, which, drying by degrees, is turned into that ruſty powder. In effect, if we examine with a microſcope, or only with a good magnifying-glaſs, plants of wheat whoſe ſtems and leaves are covered with *ruſt*, we ſhall ſee diſtinctly ſmall crevices in the places where this powder lies, and ſhall diſcern, from ſpace to ſpace, in the membrane of the plant, openings through which it ſeems probable that the juices, afterwards converted into this *ruſty* powder, iſſues, and over which one may perceive ſome ſlight fragments of the membrane imperfectly covering thoſe cracks and openings.

" In ſupport of this opinion, M. Tillet quotes[h] a memoir of M. de Renéaume, publiſhed in the Tranſactions of the Academy of Sciences, on the extravaſation of the nutritive juice of the walnut trees in Dauphiny : of the manna of Calabria, which is not a dew, but the extravaſated juice of the leaves of a kind of aſh ; and what M. Muſchenbroek relates in his Phyſical Eſſays of thick and oily juices which iſſue out at the excretory veſſels of leaves, and ſtop there in the conſiſtence of honey.

" However this may be, the *ruſt* of corn is the conſequence of a diſtemper of which the firſt cauſe is not yet ſufficiently known. It is a miſtake to think that the ruſt and mealy powder which may be ſeen on many plants are a collection of eggs laid there by inſects, and that this is a ſource of other inumerable inſects very fatal to vegetables. By admitting the extravaſation of the nutritive juices, as the cauſe of theſe diſtempers, we ſhall conceive that the *ruſt* of corn, the honey-dew, the mealy-dew, and all the unctuous ſubſtances which are found upon gramineous plants, depend on the quality of the juice concentrated in the plants, upon the outſide of which it manifeſts itſelf by evaporation, and is converted ſometimes into an impalpable powder, and ſometimes into that thick ſubſtance which is red on garden-beans, of a ruſty colour on all kinds of corn, greeniſh on the plum-tree, yellowiſh on the aſh, white on the larch-tree, *&c.*

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[f] DUHAMEL, *Culture des Terres*, *Tom.* IV. *p.* 133.

“ Theſe obſervations and reflections ſtill leave, undoubtedly, much room to wiſh for farther information. They will, however, help to point out the path to a careful obſerver, and ought to excite philoſophers to exert themſelves in a matter of ſo great importance to the public. We confeſs that we have tried to produce the ſame effects as the dry hazy weather, which occaſions the *ruſt*, by applying to the leaves of many plants, acid and corroſive liquors, to others alkaline or ſpirituous, and frequently ſuch clammy glutinous ſubſtances as might ſtop the perſpiration without hurting the texture of the plants: but none of theſe trials have produced any thing like *ruſt*. However, who can tell how far experiments may lead the judicious and attentive? Some little circumſtances which may have eſcaped us, might perhaps, if duly remarked, have led us to the object of our ſearch. The public welfare calls on all attentive obſervers, to exert themſelves on this very intereſting ſubject.

“ Count Ginanni, in a memoir printed in the *Journal économique*, for October, 1761, treats expreſly of this diſtemper, and ſays he has obſerved, with the help of a microſcope, ſmall worms lodged between the two membranes of the blades.

“ If we had any certain knowledge of the cauſes of the ruſt, we ſhould probably be enabled the more eaſily to find preſervatives againſt it: but in the mean time it will be right to collect every obſervation made by lovers of agriculture; becauſe they will certainly afford uſeful lights at one time or other.

“ M. de Chateauvieux obſerved in the autumns of 1753 and 1754, that when the corn was ruſted, the ſecond crop of hay was ſo likewiſe. The graſs turned, from a fine green, to the ugly ruſty colour of the corn: it was covered with the ſame kind of powder, and it's quantity diminiſhed ſenſibly every day; and, as the whole of a field of corn is not, uſually, affected at the ſame time, ſo this diſtemper extended only to ſome parts of the meadow.

"The cauſe of this diſtemper is undoubtedly the ſame in corn and in graſs; but it's effect is not exactly ſimilar. It may deſtroy annual plants, ſuch as corn, entirely; but in perennials, like graſs, it deſtroys only the leaves or blades. May not the preſervation of theſe laſt be owing to the taking off of thoſe leaves or blades, when they are cut for hay? But this is only conjecture; for I own that I have not yet made any obſervation on this head.

"As the ſtraw of ſmutty, mildewed or *ruſted* corn, and by the ſame rule graſs, in a ſimilar condition, may poſſibly give diſeaſes to cattle fed with it; it were to be wiſhed, for the public good, that a parcel of fodder, the moſt infected with either of theſe diſtempers, ſhould be ſet apart for the food of a certain number of beaſts. If cows or oxen, for example, remain ſound and healthy after having been fed with this growth for two or three months, we may afterwards give it them with confidence and ſafety: but if, on the contrary, they are viſibly diſordered by it, the remedy is eaſy and at hand, by feeding them with good wholeſome hay, which will carry off the diſeaſe, then known to proceed from the bad quality of the food."

The air in England ſeldom is ſo dry as to exhale all the moiſture of the glutinous exſudations, and thereby convert them into the ruſty powder above deſcribed. The extravaſation of the ſap ſeems to account for this diſtemper of plants in a much more rational manner than the thick clammy dews which ſome of our authors ſpeak of, as falling in cloſe weather, ſtopping the perſpiration of vegetables,

bles, and hindering their juices from aſcending to nouriſh the flowers, *&c.*

Mr. Miller [i] takes the true cauſe of the mildew's appearing moſt upon plants which are expoſed to the eaſt, to proceed from a dry temperature in the air when the wind blows from that point; in which caſe it ſtops the pores of plants, and prevents their perſpiration, whereby their juices are concreted upon the ſurface of their leaves; and that concretion being of a ſweetiſh nature, inſects are incited thereto. Thoſe inſects, finding there proper nutriment, depoſit their eggs, and multiply ſo faſt as to cover the whole ſurfaces of plants, and, by corroding their veſſels, prevent the motions of the ſap. He thinks it very probable that the excrements of theſe inſects may enter the veſſels of plants, and, by mixing with their juices, may ſpread the infection all over them; for it is obſervable, that, whenever a tree has been greatly infected by this mildew, it ſeldom recovers in two or three years, and many times never is entirely clear from it after. But he by no means allows theſe inſects to be the firſt cauſe of this diſtemper, as ſome have miſtakenly imagined [k].

It is obſervable, that mildews and blights frequently attack only one ſort of corn, or fruit, and leave the other ſpecies unhurt.

Having already quoted count Ginanni as a moſt ingenious author, I ſhall here give his introduction to his account of Mildew, as a ſpecimen of the accuracy and preciſion with which he writes. The farmer will thereby ſee, that he enters into ſpeculation more than would be properly ſuitable to a work intended ſolely for practice; though the curious inquirer into nature, who is not acquainted with the Italian language, or has not ſeen the original, may, perhaps, regret my not having made larger extracts from this careful and intelligent writer.

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[i] *Gardener's Dict.* Art. MILDEW. [k] *Ibid.* Art. BLIGHT.

He diſtinguiſhes two principal kinds of mildew[l], one of which ſpots the blades and ſtems of corn, and dries upon them, without ever producing any powder; but penetrates through their outward covering, and entirely dries them up. This is, generally, of a pale colour, either reddiſh, yellowiſh, purpliſh, or blackiſh; and ſometimes a variegated mixture of many colours. The other ſpeedily covers the plant with a moiſt and thickiſh ſubſtance, which afterwards becomes dry, and turns into a powder, of one or other of the abovementioned colours, but moſt commonly reddiſh or yellowiſh. This, ſays he, always fades, corrodes, and ſeparates the outer ſkin from the plant. The former extends to every ſpecies of corn; but the latter is almoſt peculiar to wheat in the blade; though it is ſometimes ſeen upon oats and barley. Some may perhaps reckon as a third ſpecies of mildew, a yellowiſh ſubſtance, or powder, ſometimes ſeen under the membrane of the blades of corn, where it raiſes bliſters, makes many little holes and cracks, and corrodes the fibres; and perhaps they may not be wrong in accounting it ſuch.

He is confident that this diſtemper is the *rubigo* of the Latins.

"For the vegetation of ſeeds," continues count "Ginanni[m], "after they have been properly de-"poſited in the earth, for their fecundity, their "ſprouting, and the increaſe and well-doing "of the plants produced by them, it is neceſſary

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[l] *Delle Malattie del Grano in Erba, Trattato Storico-fiſico, p. 7* p. 281.

" that the action of the fluid which pervades " them be duly regulated: for that fluid is operated on in them by the ſame cauſes which affect the liquor in a thermometer and barometer, " or influence the hygrometer; ſo that whenever " it's due courſe is obſtructed or weakened, or it's " quantity too much increaſed or diminiſhed, or " it's quality injured in any manner whatever, a " diſtemper will enſue. This fluid is ſubject to " two laws of motion; the one, ſimply as a fluid, " which conſiſts in an inteſtine agitation of it's minuteſt particles; and the other, as a fluid whoſe " progreſs is through the various ducts of the " plant. By the firſt of theſe motions it aſſimilates to itſelf all the homogeneous particles, and " expels the heterogeneous; and by the ſecond, it " penetrates into the various parts where thoſe " functions are to be performed. When both " theſe motions proceed naturally, equally, and " juſtly, the ſecretions are duly made, and every " part of the plant continues ſound and healthy: " but when that harmony is interrupted, the " fluid degenerates from it's natural ſtate, and the " ſecretion becomes vitiated and depraved."

" Now if the ſeveral diſtempers to which plants " are ſubject are owing to the various ways in " which the regular action of this fluid may be " hurt; and no one diſtemper can, in my opinion, " happen to corn, which will not fall under one " or other of theſe circumſtances; we ought to " ſearch after, and endeavout to diſcover them, " in order to be thereby enabled to prevent, or to " cure them, that mankind may be the leſs expoſed " to the injuries reſulting therefrom. But as the " knowledge of theſe particular things depends " on an adequate conception of thoſe which are " univerſal; and as the univerſal cauſes of diſtempers are external or internal, and the diſtempers

" themſelves ſeem particularly to depend on the " conſtitution of the air, or an alteration of food, " or on both; ſo, when we have diſcovered the " genus of the cauſe, it will not be very difficult " afterwards to find out the ſpecies, and the ef- " ficient cauſe. So many and various have been " my reſearches, obſervations, and experiments, " and ſuch the lights which they have afforded " me, that, if the love of truth did not oblige " me to be diffident of myſelf, and if I was not " thoroughly perſuaded, with that great philoſo- " pher and mathematician Gallileo, that *we can-* ' *not in general underſtand how nature acts, becauſe* ' *ſhe makes uſe of means frequently beyond the reach* " *of our comprehenſion*, I ſhould, perhaps, flatter " myſelf with thoughts of having diſcovered the " origin of ſome of the diſtempers to which corn " is ſubject whilſt in the blade."

He then gives his opinion of mildews [n], which is, that they come on very early in the morning, and cover the corn almoſt inſtantaneouſly, after a cold night, which has been preceded by a hot day; and that the ſap or moiſture which then iſſues out of the plant, is gradually exhaled, and forms the ruſty powder which characteriſes this diſtemper.

After trying in vain all the boaſted remedies of the ancients [o] (highly commended by ſeveral modern writers) ſuch as burning of ſtraw and weeds in a ſerene night, when not a breath of air is ſtirring, or the wind, if any does blow, comes only from the weſt; ſticking up branches of laurel, &c.; ſprinkling the corn with tobacco, and with pepper; and ſtrewing among it, as Dr. Hales adviſes, woollen rags ſteeped in a ſtrong ſolution of ſalt of tartar, or ſea ſalt, or in good white-wine

[n] *p.* 284. [o] *p.* 367.

vinegar, and afterwards well dried, even from which laſt he cannot ſay that he has found much benefit;; the method long ago directed in this caſe by Mr. Worlidge[p], of making two men go at a proper diſtance from each other in the furrows, holding a cord ſtretched ſtrait between them, and carried ſo as to ſhake off the dew from the tops of the corn, before the heat of the ſun has thickened it, ſucceeded beſt of all; to which he adds, as an excellent preſervative, keeping the ground perfectly free from weeds, and ſtirring the earth frequently between the plants. I ought not to omit here, M. Worlidge's farther obſervation, that, "the ſowing of wheat early has been "eſteemed, and doubtleſs is, the beſt remedy "againſt mildews; for by this means the corn "will be well filled in the ear before thoſe dews "fall, and the increaſe will conſequently be the "greater. For curioſity ſake, wheat was ſowed "in all the months of the year: that ſown in July "produced ſuch an increaſe as is almoſt incredible. "In France they generally ſow before Michael-"mas.

"Bearded wheat is not ſo ſubject to mildews as "the other, it's awns keeping the dew from the "ear."

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[p] *Syſtema Agriculturæ*, c. X. § 1.

What we expreſs by the general term

Of Blights *,

M. Duhamel divides into the following different ſpecies.

A R T. II.

Empty-ears;

"THAT is to ſay, corn of which the ears, "inſtead of being full of plump grains throughout their whole length, are entirely deſtitute

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* Mr. Miller's definition of Blights [q], taken from the obſervations of the reverend and learned Dr. Hales, is, that they are often cauſed by a continued dry eaſterly wind, blowing for ſeveral days together, without intervention of ſhowers, or any morning dew, by which the perſpiration in the tender bloſſoms is ſtopped; ſo that, in a ſhort time, they wither and decay: and, if this weather continues long, it equally affects the tender leaves; for their perſpiring matter is thereby thickened, and rendered glutinous, cloſely adhering to the ſurfaces of the leaves, and becomes a proper nutriment to thoſe ſmall inſects, which are always found preying upon the leaves and tender branches of fruit-trees, whenever this blight happens: but theſe inſects are not the firſt cauſe of blights, as ſome have imagined; though it muſt be allowed that, whenever they meet with ſuch a proper food, they multiply exceedingly.

Mr. Tull obſerves [r], that the wheat leaſt liable to be hurt by theſe inſects is the white-cone (or bearded) wheat, the ſtraw of which is like a ruſh, not hollow, but full of pith, except near the lower part, where it is very thick and ſtrong. He thinks it probable, that the ſap-veſſels of this kind of wheat lie deeper than thoſe of other ſorts, ſo that the young inſects cannot totally deſtroy them: for when it's ſtraw has the black ſpots, (which he calls the excrements of thoſe young inſects) which ſhew that the inſects have been bred there, the grain of this ſpecies remains plump, while the grey-cone and lammas-wheat mixed with it are blighted.

[q] *Gardener's Dict.* Art. BLIGHT.

[r] *Horſe-hoeing Huſbandry, p.* 155.

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tute of any at their ends, and contain only a few ſmall grains, in which there is ſcarce any flour, and which paſs through the ſieve, with the duſt and ſeeds of weeds.

"This accident, which is common in ſome years, and which then occaſions a conſiderable diminution of the crop, may be owing to ſeveral cauſes.

"1. Heavy and cold rains, when the corn is in bloom, may hinder the grains being impregnated; as it happens, under ſuch circumſtances, to grapes, which then remain ſmall and without juice.

"2. Some have aſcribed this evil to lightning; and their opinion has acquired an additional degree of probability ſince the diſcovery of the great effects of electricity, with which the air is ſo abundantly ſtored in ſtormy weather.

"3. The young ears of corn are certainly hurt ſometimes by froſt, when they are juſt coming forth; and in this caſe the part ſo injured cannot produce good grain.

"4. I add, that if the vegetation of a plant is diſordered or interrupted, by any cauſe whatever, whilſt its ſeeds are forming; the grains at the point of the ear, which are formed laſt, will ſuffer moſt. It is for this reaſon that the beſt cultivated

The *Journal Oeconomique* informs us, that an ingenious gentleman who examined the nature of the mildew upon hops, with a microſcope, found it to be a collection of the eggs of little inſects, which fly in vaſt quantities in the air while the hop is in flower; and that he obſerved that theſe inſects, which undergo various metamorphoſes, like others of their ſpecies, ſeldom attack healthy and vigorous plants, but generally fix upon the weak and ſickly; the abundant juices of the former being probably too ſtrong for them, or, as he terms it, ſo full of ſalts that they ſeldom do more than barely nip a fine ſound leaf. Hence he properly infers the neceſſity of good culture, as an excellent preſervative.

tivated corn is the leaſt liable to this accident; becauſe the frequent ſtirring of the mould keeps the plants in conſtant vigour, and helps the perfect formation of the grains throughout the whole length of the ear.

" 5. As the ſmall grains at the point of the ears are not always incapable of growing, it is plain that the emptineſs of the ears is not conſtantly occaſioned by a want of impregnation.

A R T. III.

Of parched and ſhrivelled corn.

" CORN is ſaid to be *parched* and *ſhrivelled*, " when it's grains, inſtead of being plump, ſmooth, and full of flour, are wrinkled in their outward ſurface. Theſe grains yield, indeed, good flour: but the quantity of it is ſmall in proportion to their bran, which is full as conſiderable as that of the beſt wheat. However, if this diſtemper does not prevail to a very great degree, theſe grains, though parched or ſhrivelled, ſprout very well, and are good for ſeed.

" This defect is certainly occaſioned by ſome accident which hinders the free aſcent of the nutritive juices into the grain when it is almoſt formed. By this means the grain, which has attained it's full ſize, but is precipitately hurried on to maturity before it's mealy part is perfected, muſt infallibly be parched or ſhrivelled. It is evident that ſeveral circumſtances may produce this deſtructive accident.

" 1. If the corn is beaten down or laid, while the grains are yet in their milky ſtate, the broken or only bent ſtalk ceaſes to convey the neceſſary nouriſhment to the ear; and the grains, which no longer receive their due ſuſtenance, ripening without being filled with flour, remain ſtinted, dry, and *ſhrivelled.*

" 2. If great heats come on while the corn is yet green, the ſtalks dry, and the grains ripen ſuddenly, without being filled with flour: ſometimes there is not any flour at all in them; and in either of theſe caſes, they are *parched.*

" 3. The late corn, and that which has had too much moiſture, are the moſt liable to this accident *.

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* " The diſadvantage which late ripe corn lies under in point of coarſeneſs, may be collected from the late ripe nuts hanging on the trees in the beginning of September, or at leaſt at Michaelmas, eſpecially if rain falls about that time: for notwithſtanding the kernel of the nut is ſecured by a ſhell, yet at that ſeaſon of the year, the cold damp air, the dews, and rain, penetrate the ſhells of nuts, whereby the kernels change their colour, become wateriſh, and in a manner taſteleſs; and doubtleſs the ſame evil falls on the late ripe corn.—Some farmers, particularly in the hilly part of Hampſhire, are pleaſed when September is come, becauſe the nights are generally froſty in that ſeaſon, and then, ſay they, the corn ripens as faſt by night as by day: and indeed, adds Mr. Liſle [c], they always found it ſo at Crux Eaſton (his eſtate in that county). " But," continues he, " notwithſtanding this obſervation, with which our " farmers comfort themſelves, I would not willingly have corn " to be ſo ripened; for in truth ſuch ripening may be more " properly called blighting; inaſmuch as ripening implies filling the grain, and ſomewhat leading to it's perfection: but " theſe froſty nights rather ſhrink, and dry up the grain, and " ſtop it's filling and plimming. In like manner all ſorts of " fruits may be ſaid to be ripened by the froſts, inaſmuch as " they precipitate to a rottenneſs, &c. My opinion is, that " ſuch blighted or froſt bitten corn, not arrived to it's natural " ripeneſs, can never have a goodneſs in it's flour like that " which is ripened thoroughly, nor be ſo profitable; though " it may poſſibly be as big.——If harveſt proves late, as in " the latter end of Auguſt, wheat and barley that is then to " fill, muſt run thin, and the ſame is true of all ſorts of grain; " and in a wet ſummer the vale-corn, which uſually runs to " ſtraw, will keep the ground cold, and prevent the filling of " the grains."

[c] *Obſervations in Huſbandry, Vol.* I. *p.* 239.

" 4. M. Tull ſays that, in cold countries, there are inſects which, by pricking the ſtems of the wheat, intercept the courſe of the ſap, and occaſion the diſtemper here ſpoken of: but as it has not fallen in my way to obſerve any ſuch inſects, I ſhall not enlarge on this article.

" Upon the whole, it is certain that, without pretending to exclude other cauſes, wheat fallen or lodged before its grains are ripe, produces *ſhrivelled* grains; and that ſuch grains as are ripened too ſoon by a ſtrong and ſudden heat, are liable to the ſame defect, or to that of being *parched.*

A R T. IV.

Of glazed Corn.

" I Ought not to omit, in this enumeration of the diſtempers of wheat, a defect which, though of no great conſequence in itſelf, diminiſhes a little the quality of the grain that has it, and conſequently lowers its price, eſpecially in plentiful years, when buyers are apt to be nice.

" Men ſkilled in wheat require that it be heavy, of a ſmooth ſurface, and of a bright light yellow colour. If it is of a dead white, they judge that it has been waſhed, and have therefore ſome reaſon to reject it: and if it is of a deep yellow, and inclining to be tranſparent, they call it *glazed wheat*, and are not ready to purchaſe it. This defect happens to corn that has been ripened by great heats which have come on juſt before the flour was quite formed.

" This *glazed* corn ſprouts very well, yields plenty of good flour, and makes good bread: but I ſuſpect that this flour does not take ſo much water to knead it, as the flour of the beſt wheat does. This is the only defect I know of in glazed wheat; nor indeed am I quite certain of the fact. I men-

I mention it here only as a caution to thoſe who may have ſuch corn to diſpoſe of, that they may not be impoſed upon by dealers who might exaggerate this fault, in order to depreciate what they are glad to buy.

M. Liſle lays a ſomewhat greater ſtreſs upon the colour of corn, which, ſays he (vol. I. p. 238), whether of wheat or barley, gives a great preference with the huſbandman in a market, that does not a little puzzle the inquiſitive gentleman, a ſtranger to huſbandry, who hears it: but the reaſon for it is this: there is an uniformity between the colour of corn and it's weight; and the latter never fails to be accompanied with the former quality, which therefore denotes it's goodneſs. Wheat weighs light, becauſe it has not come to its full maturity, and ſo has not ſufficiently diſcharged the watery parts, which proceed chiefly from the coldneſs of the ground, that wanted ſpirit to carry the grain to a full perfection of ripeneſs: and the defect of colour may be occaſioned by too much rain, which ſogged the grain in harveſt, whilſt ſtanding, or in gripp; for being wet and dried again, every time it was dried, after being wet and full ripe, the moiſture exhaled by the ſun's drying it carried alſo away a tincture of, or the particles of it's colour, along with the exhalation of the watery parts, and therefore the grain muſt be the more porous, leſs ſolid, and conſequently lighter. The ſame argument will hold for barley.——All corn is apt to grow brighter as it grows towards earing: but that which then moſt holds the deep green colour, is likelieſt afterwards to have the largeſt and boldeſt ears, and to bring the grain beſt to perfection. The ſame gentleman obſerves, that dry weather at the earing time prevents corn from getting well out of the hood; and that, as the Latin writers noticed long ago, rainy weather prejudices all ſorts of corn at the blooming time, except the leguminous kinds, becauſe the wet falls into the huſk of wheat, barley, and oats, which opens at that time, and ſo is corrupted by the water ſtanding on it; whereas the pods of leguminous grains lie within the leafy flower, into which the wet cannot enter.

A R T. V.

" *Of abortive, or rickety corn.*

" M. Tillet, whoſe writings firſt made me acquainted with this diſtemper, repreſents it as a very fatal one. It ſhews itſelf long before the ripening of the corn. and even when the plants are not above a foot and a half high. The marks which characterize it are, a deformity of the ſtem, of the blades, of the ear, and even of the grain.

" Abortive plants are not, in general, ſo tall as ſound ones of the ſame age. Their ſtem is crooked, full of knots, and, in ſhort, rickety: their blades are commonly of a bluiſh green, and curled various ways: their ears retain but very little of their natural ſhape; they are meagre, dry, withered, and preſent but very imperfect beginnings, either of the coverings, or of the grain.

" All theſe ſymptoms do not unite in the ſame plant, unleſs the diſtemper be at the worſt. Frequently the ſtems are pretty ſtrait, the blades not much curled, and the cheſts tolerably well formed; but inſtead of incloſing a ſmall white downy embrio at their ſummit, they cover only a green grain, terminated in a point, and ſhaped almoſt like a pea beginning to form in it's pod.

" Theſe abortive grains have often two or three very diſtinct points, which make them look as if two 'or three grains were joined together at their bottom. When theſe grains have attained their maturity, or rather when they are grown dry, they turn black, and look ſo like the ſeed of cockle, that many farmers, who are unacquainted with this diſtemper, confound the abortive grains with the ſeeds of that plant.

" The following are the principal obſervations which M. Tillet has made on this diſtemper.

" 1. The abortive ears generally grow on ricketty ſtalks, of a white colour, with curled leaves.

" 2. The ſtalks appear rickety as ſoon as they are three or four inches high.

" 3. While the rickety ſtalks are yet low, they are weak, and of a yellowiſh hue : their blades are of the ſame colour, and ſomewhat crinkled, or curled, as if they were blighted : yet the rickety ſtalks very often look ſtronger than others.

" 4. As the rickety ſtalks grow, they become of a green colour, and afterwards, change to that bluiſh hue which is their diſtinguiſhing character: their blades remain curled, become likewiſe bluiſh, and never have the ſtrength and conſiſtence of ſound blades.

" 5. This is not a diſtemper peculiar to corn growing in poor ground. M. Tillet has obſerved it in a rich ſoil, and even in the middle of a tuft of fine wheat; and he has ſearched for it in vain in poor ſoils, where the corn was but in a languiſhing condition.

" 6. The roots ſeemed to partake a little of the ſame diſtemper. They were not entirely covered with their ſoft ſpungy coat, and in ſome parts they were grown hard like wood.

" 7. Rickety plants ſeldom bear ears either entirely good or entirely bad. Whenever they produce any of the former, thoſe good ears grow on upright ſtalks, of which the blades are but little curled.

" 8. The abortive grains reſemble very young peas and preſent one, two or three very diſtinct points.

" 9.

9. The abortive grains, which uſually grow on rickety ſtalks with curled leaves, are ſometimes intermixed with carious or rotten grains, which proceed from the ſame root, and grow on upright ſtalks, whoſe blades are not curled.

" 10. Rickety plants bear ſometimes ears which contain ſound grains, and others which are abortive.

" 11. The abortive grains adhere but very little to the bottom of their cheſts, or huſks; for which reaſon they ſhed eaſily when their coverings are opened.

" 12. An abortive grain ſeldom has three membranes, like ſound grain: ſometimes it has two membranes; but moſt commonly only one, or none at all.

" 13. The abortion of the grains is ſometimes quite completed, before the ear comes out of it's hood.

" 14. After that the ears of rickety plants have been expoſed to the air for ſome time, their huſks grow white, and the abortive grains become black and dry.

" 15. We ſometimes meet with ſtalks of wheat, which are ſtrait, pretty tall, and have only the blades of the third or fourth joint ſhrivelled or curled, though of the rickety kind, In this caſe the ear contains, 1, abortive grains compoſed of one, two, or three parts; 2, abortive grains incloſed in the ſame cheſts with a white grain which has one or two yellow membranes; 3, white grains furniſhed with three very green membranes, which ſeem to promiſe well.

" The diſtemper diſtinguiſhed by the name of abortive or rickety wheat is well deſcribed and characteriſed by theſe obſervations. I have copied them faithfully from M. Tillet's diſſertation which gained the prize of the academy of Bourdeaux, the better to make known a diſtemper which, ſays the author of that excellent performance, is almoſt unknown to the generality of huſbandmen. But as I have not obſerved this diſtemper ſo attentively as that gentleman has done, I ſhall not attempt to hazard any conjectures concerning it's cauſe; and ſhall only obſerve, that M. Tillet ſuſpects it to be occaſioned by inſects, and ſays he has perceived on the diſtempered ſtalks, where he found inſects, ſmall drops of a very clear liquid, which he takes to be extravaſated ſap.

A R T. VI.

Of barren ears.

"THE laſt diſtemper I have to ſpeak of, is that which M. Aimen calls *barrenneſs*. The ears of wheat, ſays he, and alſo thoſe of rye, are, in this caſe, longer than they would otherwiſe be, lank, and white: in ſome, the membranes are dry, tranſparent, and tough; the female organs are ſmall, whiter, and more downy than in ſound ears: in others, the veſſels are ſwelled, and all the parts are imperfectly formed.

"M. Aimen thinks, as Theophraſtus did, that theſe accidents happen to thoſe plants which grow with moſt vigour: for in them, ſays he, the too great quantity of ſap in the blades or other parts of the plants, prevents the bloſſom's being duly formed.

"He thinks likewiſe that froſt may occaſion this accident, by affecting particularly the female organs: and he is of opinion that a ſudden ſcorching heat of the ſun immediately after a heavy rain, may produce the ſame effect. If ſo, this diſtemper may be claſſed with that which renders corn parched or ſhrivelled; and perhaps too, not improperly, with that of empty ears. According to the ſame obſerver, inſects are but ſeldom, though they are ſometimes, the cauſe of the diſtemper here ſpoken of."

Count Ginanni, judging that the barrenneſs of corn is often owing to the poorneſs of the ſoil, rightly adviſes [a] the huſbandman, in this caſe, to enrich the land and change the ſeed.

ART. VII.

Of fallen or lodged corn.

"THE fineſt, talleſt, and ſtrongeſt plants, are not always thoſe which yield the greateſt quantity of grain, or the beſt. The ſtems of corn grow and ſhoot up pretty perpendicularly, unleſs ſome accidental cauſe ſubvert this order of nature. The moſt frequent accidents of this kind are wind and rain. The ſtem, which is ſupple, bends indeed, and thereby gives way to the force of the wind; and by means of it's elaſticity, it recovers it's naturally perpendicular poſition upon the ceaſing of the wind: but when much rain accompanies the wind, the ears of the corn become loaded with wet, and the ſtalks, which are tender near the ground, break: the plants then cannot riſe up again; and if there be weeds at the bottom of the ſtems, they will ſoon top the corn, and effectually prevent it's riſing: but if, as it frequently happens, the ſtems of the corn are only bent or inclined, and not broken, they will riſe again when the wind and rain are over, and be very little damaged. If the accident of their being lodged and broken happens ſoon after the ears have done bloſſoming, the grains, which then receive but little nouriſhment, remain very ſmall, and contain ſcarce any thing but bran. In this caſe, the loſs becomes very conſiderable; for, beſides the injury ſuſtained by the grain, the very ſtraw rots, and becoms unfit for the food of cattle.

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[a] p. 382.

" If the corn be not lodged before it is almoſt ripe, the grains will then be only ſhrivelled, and a tolerable crop may be reaped if the time of harveſt proves warm and dry: but if it be rainy, ſuch corn will be very apt to grow in the ear.

" Laſtly, if too high winds happen when the corn is ripe, it's grains will ſhed, and it's ſtems will be intangled, to the great detriment of the farmer, and to the no ſmall trouble of the reaper, howſoever careful both of them may be.

" Corn which is only bent, riſes again ſometimes, as I ſaid before. In this ſituation, the plants continue to grow, *&c.* their ears increaſe and become full of grain, which ſometimes is not even ſhrivelled. What is moſt to be feared for corn in this ſituation, is, that birds may perch upon it, devour the grain, and, by their weight, complete the lodging of the plants. This accident excepted, the huſbandman need not be uneaſy at ſeeing his corn inclined. It's being in that ſituation, may even be of ſervice to it ſometimes; becauſe, as was ſaid before[e], wet cannot get into the ears when they are bent downward, as it does when they ſtand upright; and their grain, in the former caſe, will always be fitteſt for keeping. The bent ears will likewiſe be the leaſt liable to be ſhaken by the wind: but there will be room to fear their bending more and more, and at laſt their ſprouting, if rain comes on and laſts too long.

[e] p. 221.

“ If the huſbandman could foreſee that the ſeaſon would be very favourable to the growth of corn, he would not by any means enrich his already good lands, becauſe he would not chooſe to be inſtrumental in the lodging of his corn : for it is in thoſe kindly years that the fineſt, beſt cultivated, and moſt dunged crops are the moſt apt to be lodged, and then to yield the huſbandman the ſmalleſt return. In the year 1761, the low corn produced finer and better grain, than the talleſt and at firſt moſt promiſing.

“ But as it is not given to man to have that fore-knowledge, farmers plow and manure their land as well as they can, and if they find their corn grow too rank, they ſometimes mow it. By this means they check the growth of the plants, and conſequently prevent their riſing too high. This anſwers the deſign of guarding againſt their being lodged ;” as does alſo the turning in of ſheep, to eat down the too luxuriant blades : but both theſe methods are very wrong ; for the farmer thereby certainly leſſens his crop, and at leaſt brings it on the level of a ſecond crop, where the ears are always ſmall and light. For fear of the grain's ſhrivelling, if the corn ſhould be lodged, he recurs to means which infallibly render the ears ſmall and leſs ſtored with grain. Beſides this, the grain is generally good when it ripens in due ſeaſon : but by feeding or cutting down the corn, it's growth and ripening are retarded, and it conſequently is expoſed to all the inconveniencies of a late harveſt.

It is agreed, that corn which grows in a rich ſoil is tall, and more liable to be lodged than that which is ſtinted in it's growth. But this is owing to the weakneſs of the ſtraw, and not to the weight of the ears, let them be ever ſo full of grain. The buſineſs therefore here is to give the ſtems as much ſtrength as poſſible. To this end, it is neceſſary that the ſun and air have free acceſs to them, and that the plants receive ſufficient nouriſhment while they are in the earth; for we frequently ſee that tufts of wheat which chance to grow ſeparate from others, and ſtand in ſuch a manner as to be expoſed on all ſides to the ſun and air, are much leſs apt to be laid than thoſe which grow in the middle of large fields of corn. In the common huſbandry, the plants generally have but a ſcanty portion of food; and, as their ſtalks ſtand cloſe together, ſmothered and ſtifled as it were, they are tender and brittle: but in the new huſbandry, where they receive abundant nouriſhment during the whole time of their growth, and are always expoſed to the air and ſun, the ſtalks become large and ſtrong enough to ſupport the ears. Many experiments in this huſbandry have likewiſe proved, that the turning of the earth towards the roots of corn at the laſt hoeing, contributes greatly to give ſtability to the ſtems after they have attained their height, and renders the corn leſs liable to be lodged. M. Duhamel had a remarkable proof of this in the year 1750, when a field of his, ſowed in rows, and cultivated in the new way, which made the wheat there grow very tall, and rendered it's ears uncommonly large and full of grain, eſcaped unhurt; whilſt the corn was beaten down in moſt of the neighbouring lands: and the reader has already ſeen farther inſtances to the ſame effect, in M. de Chateauvieux's experiments.

To ſet the cauſe of the lodging of corn in a yet clearer light, it will be proper to take ſome notice of the uſe of the leaves and roots of plants, ſo far as relates to this ſubject.

Experience has ſhewn that trees may be killed by ſuddenly ſtripping them of all their leaves.

The mulberry trees whoſe leaves are not gathered, flouriſh better than thoſe from which they are plucked off. Trees make much finer ſhoots in years in which there are but few or no inſects, than in thoſe in which their leaves are devoured by them; and it has been obſerved that many of their ſmall boughs wither and decay, when their leaves have been eaten up by caterpillars and gnats during ſeveral years running. The inſect which preys upon the leaves only of the bon-chrétien pear-tree[b], hinders that tree from bearing fine fruit. When the blades of corn have been mildewed, the plant droops and languiſhes, till it has produced new leaves.

Another obſervation which proves the great utility of the leaves of plants is, that ſo long as trees continue to ſhoot, their fruits do not attain a perfect maturity. M. Duhamel tried to haſten that maturity, by pulling off the leaves; but the fruit ſuffered thereby, if it was not full-grown and ready to ripen: in this caſe, indeed, the pulling off the leaves was of ſervice to it.

The lovers of agriculture are invited to try whether a too forward tree may not be made to bear fruit ſooner than uſual, or the too rapid growth of luxuriant branches be ſtopped, by taking off great part of it's leaves at different times. Let a farmer cut ſome of his too rank corn, and leave ſome uncut; and let him examine in autumn which ripens the ſooneſt, and has the beſt ears, of that which is not laid.

Writers upon vegetation have proved, that the leaves tranſpire great part of the juices of plants (probably that part which is of no uſe to the plant); and that they likewiſe imbibe the moiſture of rain and dews; even that which floats inviſibly in the air. Their leaves are therefore of great uſe, particularly when, in a dry ſeaſon, the chief nouriſhment of plants can be derived only through them from the dews or moiſture of the air. Thus, in a dry ſpring, early corn thrives and continues to flouriſh, whilſt all the crops which had not plenty of blades before the drought came on, are ſtinted. If, in ſuch a ſeaſon, the farmer turns his lambs into a field of wheat, and much more if he mows it, (becauſe the dung which proceeds from the lambs, and their ſtirring the ſurface of the ground, may enrich and looſen the ſoil,) the ſurface of the earth remains dry, and the corn does not ſhoot, as may be ſeen every year when hay is cut in a dry ſeaſon; in which caſe the ground is ſoon parched up, while the graſs that remains uncut thrives and continues to increaſe in quantity; not ſo much from moiſture in the earth, becauſe upon digging it will be found quite dry, as from the moiſture of the air.

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[b] DUHAMEL, *Elements d'Agriculture, Tom.* I. *p.* 29.

Plants growing on the north ſide of an eminence ſuffer leſs from drought, than thoſe which grow on the ſouth; becauſe in the former ſituation, cold condenſes the dew or moiſture of the air ſooner than where the air ſtill retains it's warmth; and perhaps they are leſs exhauſted there by tranſpiration.

In ſome caſes, the imbibition of moiſture may be hurtful to the plants. For example, when the ſeaſons are cold and rainy, thoſe plants which are ſkreened from the ſun and wind ſuffer more than others, becauſe their veſſels are choaked, as it were, with a moiſture which corrupts, breeds rottenneſs, and kills the plants; whereas thoſe which are in an open expoſure receive the benefits of the ſun and wind. and are aſſiſted by tranſpiration.

Mr. Liſle, after mentioning lord Bacon's obſervation that corn frequently does not ſpindle well, or come rightly out of the hood, in hot countries, by reaſon of the great heat and drought; ſays, he himſelf has found, from conſtant experience, that wet years make the ſtraw of all corn ſo weak, ſmall, and thin, that it is apt to lodge. Whilſt, on the other hand, in dry hot ſummers all ſtraw is thick and ſtrong. He adds, that cold wet land has the ſame effect as cold wet weather, and that "the ſtraw in wet years runs the coarſer, and that "in dry hot years the finer; in which laſt caſe it "has the more ſpirit in it: which is the reaſon why "in hotter countries than England the cattle eat "ſtraw ſo much better than with us."

If any benefit ariſes from pulling off the leaves of too vigorous trees, in order to check their growth; for the ſame reaſon thoſe of weak plants ought to be taken particular care of: for theſe organs of tranſpiration are extremely fit to revive the motion of the ſap.

It may be alledged, that the cutting of lucerne, for example, does not hurt the plant. It is true, becauſe that plant ſhoots it's roots ſo deep, that it draws nouriſhment from moiſture little expoſed to be carried off by drought: but if the lucerne be mowed very frequently, or eaten cloſe by cattle for any time, the plants will then be found to loſe their vigour, and vegetate much more ſlowly than when cut at due diſtances of time: for the ſupply of moiſture furniſhed by the leaves being thereby cut off for a time, the ſoil is ſoon exhauſted of it's moiſture, and the plant decays. It can ſcarcely be doubted, but that part of the moiſture taken in by the leaves of a plant vegetating and in vigour, is not only conveyed to the roots, and tranſpired by them into the ſoil, which it moiſtens and looſens ſo as to facilitate the farther extenſion of thoſe roots; and that it may alſo ſoon become again fit to be taken up by the plant.

Stripping a tree of all it's leaves when it is in full ſap, immediately binds the bark, which does not looſen again till a new growth of leaves brings on a freſh circulation of the juice. Thence conſequently ariſes a manifeſt ſtop to vegetation.

It is evident from the above-mentioned inſtance of the ſtrength acquired by a tuft of corn growing by accident ſingle, ſuch as to be proof againſt wind and rain, that the want of that ſtrength is a principal cauſe why corn is lodged. When the ſeed is ſowed thick, the plants come up weak and tall; two circumſtances which infallibly contribute to their being beaten down. The farmer, who knows the richneſs of his ſoil, ſhould therefore ſow in ſuch manner as to allow room for each plant to acquire that proper ſtrength: and that this will effectually anſwer the intended purpoſe, appears by many inſtances in the foregoing experiments. I could likewiſe confirm the truth of what is here advanced, by the example of a very intelligent huſbandman now living, who reduced his ſeed, for rich ground, to much leſs than two buſhels to the acre; and had plants, loaded with heavy ears, ſufficiently ſtrong to reſiſt ſuch rain and wind as laid the corn of his neighbours in adjacent fields.

G.R III
BRITISH MUSEUM

END OF THE SECOND VOLUME.

DIRECTIONS TO THE BOOK-BINDER.

Place all the Plates ſo that they may open towards the Right-hand.

The Plates in this Second Volume are

Pl. I.	P. 38.
II.	53.
III.	61.
IV.	78.
V.	86.
VI.	100.
VII.	114.

ERRATA.

p. 30. l. 7. *for* rake *read* bin
77. l. 23. *for* Pl. IV. *read* Pl. V.
182. l. 28. *for* fruitleſſneſs *read* fruitfulneſs
382. l. 9. p. 384. l. 4. p. 388. l. 3. p. 392. l. 19. and 395. l. 32. *for* Sect. *read* §.